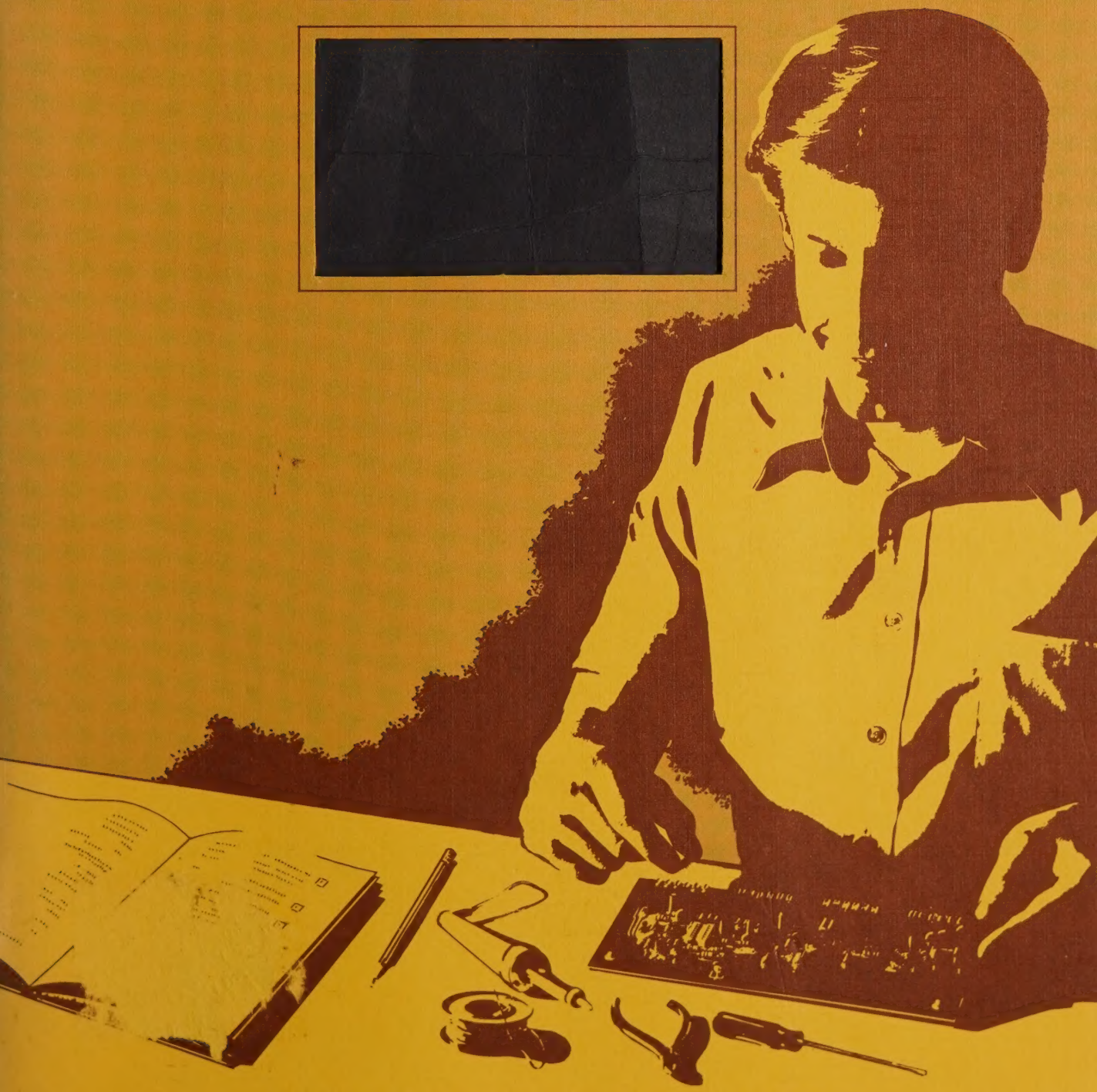
HEATHKIT® MANUAL



HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information ..... (616) 982-3411
Credit ..... (616) 982-3561
Replacement Parts ..... (616) 982-3571

Technical Assistance Phone Numbers
8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only

R/C, Audio, and Electronic Organs ..... (616) 982-3310
Amateur Radio ..... (616) 982-3296
Test Equipment, Weather Instruments and Home Clocks ..... (616) 982-3315
Television ..... (616) 982-3307
Aircraft, Marine, Security, Scanners, Automotive, Appliances and General Products ..... (616) 982-3496
Computers ..... (616) 982-3309

YOUR HEATHKIT 90 DAY LIMITED WARRANTY

If you are not satisfied with our service - warranty or otherwise - or with our products, write directly to our Director of Customer Services, Heath Company, Benton Harbor, Michigan 49022. He will make certain your problems receive immediate, personal attention.

Our attorney, who happens to be quite a kitbuilder himself, insists that we describe our warranty using all the necessary legal phrases in order to comply with the new warranty regulations. Fine. Here they are:

For a period of ninety (90) days after purchase, Heath Company will replace or repair free of charge any parts that are defective either in materials or workmanship. You can obtain parts directly from Heath Company by writing us at the address below or by telephoning us at (616) 982-3571. And we'll pay shipping charges to get those parts to you — anywhere in the world.

We warrant that during the first ninety (90) days after purchase, our products, when correctly assembled, calibrated, adjusted and used in accordance with our printed instructions, will meet published specifications.

If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period through no fault of yours, we will service it free upon proof of purchase and delivery at your expense to the Heath factory, any Heathkit Electronic Center (units of Schlumberger Products Corporation), or any of our authorized overseas distributors.

You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

Our warranty does not cover and we are not responsible for damage caused by the use of corrosive solder, defective tools, incorrect assembly, misuse, fire, or by unauthorized modifications to or uses of our products for purposes other than as advertised. Our warranty does not include reimbursement for customer assembly or set-up time.

This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. **We are not responsible for incidental or consequential damages.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

HEATH COMPANY
BENTON HARBOR, MI. 49022

Prices and specifications subject to change without notice.

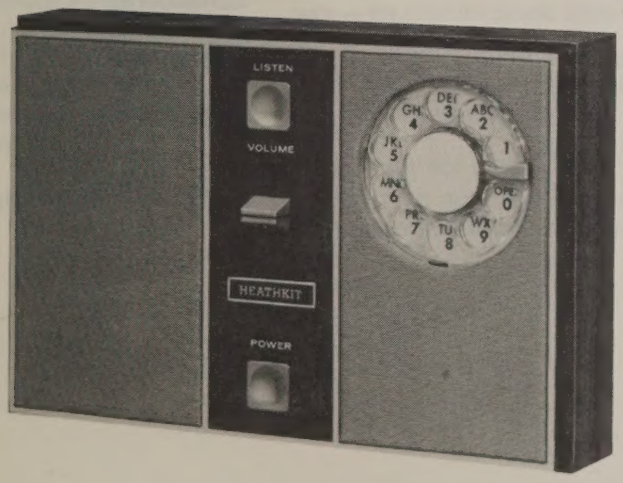
Heathkit® Manual

for the

TELEPHONE AMPLIFIER WITH DIALER

Model GD-1162

595-1789-02



WARNING: To prevent shock hazard, do not expose this appliance to rain or moisture.

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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TABLE OF CONTENTS

INTRODUCTION 3

PARTS LIST 4

IMPORTANT ASSEMBLY NOTES 13

STEP-BY-STEP ASSEMBLY
Circuit Board 14
Circuit Board Checkout 31

FINAL ASSEMBLY 43

INSTALLATION
Introduction 50
STC Coupler Installation 51
STC Coupler Test 52
QKT Coupler Installation 52
QKT Coupler Test 53
Direct Hookup Installation 54
Direct Hookup Tests 57

OPERATION 60
Direct Hookup or STC Coupler 61
QKT Coupler 61
Harmonic Ringing 61

IN CASE OF DIFFICULTY
Visual Inspection 62
Troubleshooting Charts 63

ALIGNMENT WITH INSTRUMENTS 66

SPECIFICATIONS 67

CIRCUIT DESCRIPTION 68

CIRCUIT BOARD X-RAY VIEW 71

TRANSISTOR-DIODE-IC
IDENTIFICATION CHARTS 72

SCHEMATIC . . . . . In "Illustration Booklet"

WARRANTY . . . . . Inside front cover

CUSTOMER SERVICE . . . . . Inside rear cover

INTRODUCTION

The Heathkit Model GD-1162 Telephone Amplifier connects to your telephone line directly or through couplers and permits normal telephone conversations without the use of a telephone handset. The Amplifier has its own dialer and ring detector that generates a tone in the speaker when a ring signal is present on the line. This unit can replace the conventional telephone in your home.

Some unique features of the Telephone Amplifier include:

- A "listen" switch than enables you to interrupt your conversation with the person you are phoning, and carry on a private conversation with another individual or individuals in your presence.
- A Volume control that regulates the loudness of the incoming signal.
- A sensitive microphone and amplifier circuit that allows you to be up to 10 feet away from the Telephone Amplifier and still carry on a conversation.
- A 6 foot connecting cord that allows you to install the unit on a wall or to place it on a desk top.

A 9-volt source is required to operate the Amplifier. This can be either a transistor radio battery or a converter-charger such as the Heathkit Model GRA-43-1.

The Amplifier is contained in an attractive wood grained plastic case with a decorative grille that allows it to match a variety of home and office decors.

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

PARTS LIST

Remove the parts from the pack and check each part against the following list. Make a check (✓) in the space provided as you identify each part. The key numbers correspond to the numbers next to the illustration on the right-hand side of the Page. Any part that is packed in an individual envelope with the part number on it should be placed back in the envelope after you identify it until it is called for in a step. Do not discard any packing materials until all parts are accounted for.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with the kit. If one is not available, see "Replacement Parts" inside the rear cover of the Manual. For pricing information, refer to the separate "Heath Parts Price List."

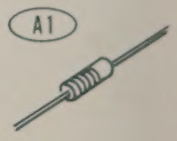
Each circuit part in this kit has its own component number (R2, C4, SW1, etc.). This is a specific number for only that one part. The purpose of these numbers is to help you easily identify the same part in each section of the Manual. These numbers will appear:

- In the Parts List,
- At the beginning of each step where a component is installed,
- In some illustrations,
- In the Schematic,
- In the sections at the rear of the Manual.

KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.

RESISTORS

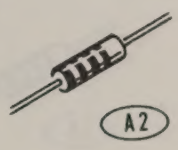
NOTE: The resistors may be packed in more than one envelope. Open all the resistor envelopes in this pack before you check them against the parts list.



1/4-Watt, 10% (Fourth band silver)

A1 ( )	1	220 Ω (red-red-brown)	1-17-12	R77

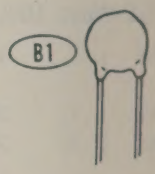
KEY No.		QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
Resistors (cont'd.)					
1/2-Watt, 10% (Fourth band silver)					
A2	( )	1	4.7 Ω (yellow-violet-gold)	1-129	R37
A2	( )	3	22 Ω (red-red-black)	1-49	R13, R21, R22
A2	( )	2	82 Ω (gray-red-black)	1-118	R19, R73
A2	( )	2	560 Ω (green-blue-brown)	1-119	R35, R78
A2	( )	3	820 Ω (gray-red-brown)	1-8	R14, R15, R17
A2	( )	2	1000 Ω (brown-black-red)	1-9	R33, R56
A2	( )	2	2200 Ω (red-red-red)	1-44	R38, R41
A2	( )	1	3300 Ω (orange-orange-red)	1-14	R28
A2	( )	2	3900 Ω (orange-white-red)	1-46	R6, R27
A2	( )	3	6800 Ω (blue-gray-red)	1-19	R3, R18, R34
A2	( )	5	10 kΩ (brown-black-orange)	1-20	R12, R36, R47, R71, R72
A2	( )	2	22 kΩ (red-red-orange)	1-22	R8, R74
A2	( )	9	39 kΩ (orange-white-orange)	1-67	R2, R4, R55, R57, R59, R62, R64, R66, R69
A2	( )	2	68 kΩ (blue-gray-orange)	1-60	R9, R63
A2	( )	1	82 kΩ (gray-red-orange)	1-102	R44
A2	( )	11	120 kΩ (brown-red-yellow)	1-121	R11, R31, R42, R43, R45, R52, R54, R58, R61, R75, R76
A2	( )	3	270 kΩ (red-violet-yellow)	1-30	R32, R39, R65
A2	( )	3	470 kΩ (yellow-violet-yellow)	1-33	R5, R51, R53
A2	( )	4	1.5 MΩ (brown-green-green)	1-36	R46, R49, R67, R68
A2	( )	1	3.3 MΩ (orange-orange-green)	1-38	R1
A2	( )	1	10 MΩ (brown-black-blue)	1-40	R48
1/2-Watt, 5% (Fourth band gold)					
A2	( )	2	100 kΩ (brown-black-yellow)	1-104	R23, R25
A2	( )	3	220 kΩ (red-red-yellow)	1-59	R16, R24, R26



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.

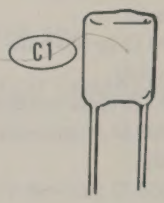
CAPACITORS

NOTE: Capacitors can be marked four different ways. EXAMPLE: .1, .1k, or (.1 μF or pF). However, the parts list and installation instructions will always use μF or pF.



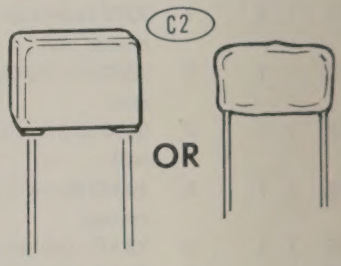
Disc

B1 ( )	2	100 pF	21-75	C6, C24
B1 ( )	2	500 pF	21-13	C4, C9
B1 ( )	4	.001 μF	21-140	C14, C15, C33, C34
B1 ( )	3	.005 μF	21-46	C5,C8,C23
B1 ( )	5	.01 μF	21-176	C3,C16,C21, C30,C32



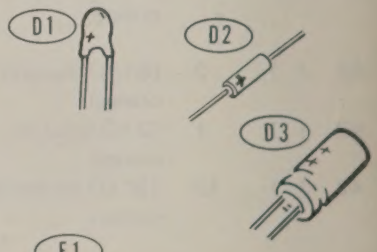
Mylar*

C1 ( )	5	.1 μF	27-47	C7, C17, C18, C19, C28
C2 ( )	1	.22 μF, 200V	27-60	C35
C3 ( )	1	2.2 μF	27-90	C12



Tantalum Electrolytic

D1 ( )	5	.68 μF	25-200	C1, C26, C27, C29, C31
D2 ( )	1	1 μF	25-197	C10

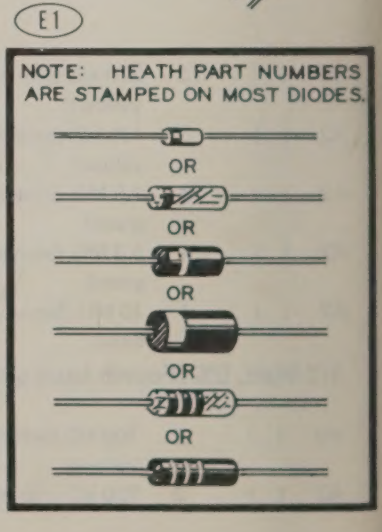


Electrolytic

D3 ( )	6	10 μF	25-115	C2, C11, C13, C22, C25, C36
D3 ( )	1	100 μF	25-117	C37

DIODES

E1 ( )	1	1N4166A zener	56-25	ZD9
E1 ( )	4	1N4149 silicon	56-56	D13,D14,D15, D16
E1 ( )	4	1N4148 silicon	56-84	D1,D2,D11, D12
E1 ( )	4	1N4002 silicon	57-65	D5,D6,D7, D8



*DuPont Registered Trademark

KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.

TRANSISTORS

NOTE: Disregard any color markings on transistors.

F1 ( )	1	SM07275	417-283	Q1
F2 ( )	8	MPSA20	417-801	Q3, Q7, Q9, Q14, Q15, Q16, Q17, Q18
F2 ( )	1	MPSA05	417-864	Q5
F3 ( )	6	2N4121	417-235	Q4, Q8, Q11, Q12, Q13, Q19
F4 ( )	1	MRD14B	417-859	Q21
F5 ( )	2	P1087E	417-858	Q2, Q6

INTEGRATED CIRCUIT

NOTE: If either the "Part Number" or the "Description" number is on an integrated circuit, you have the correct part. Do not be concerned about any other numbers. The Description number may have additional letters and numbers other than those given in this list. Example: SN(7473)N or MC(7473)P.

G1 ( )	1	324 or 3403	442-602	IC1
G1 ( )	1	3302 or 2901	442-616	IC2

HARDWARE

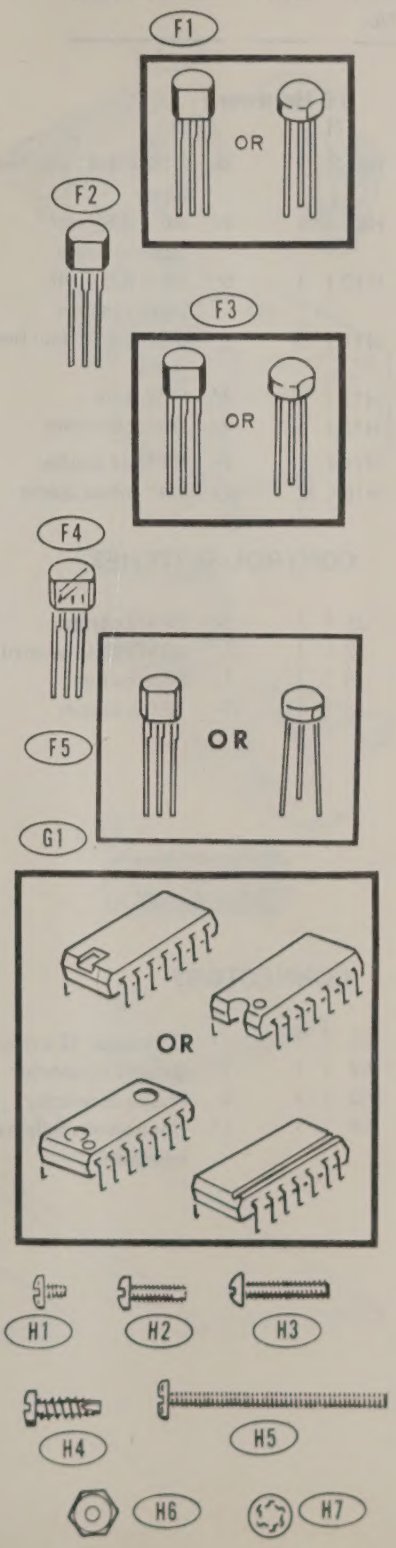
NOTE: The hardware may be in more than one packet. Open all the hardware packets in this pack before you check the hardware against the Parts List.

#3 Hardware

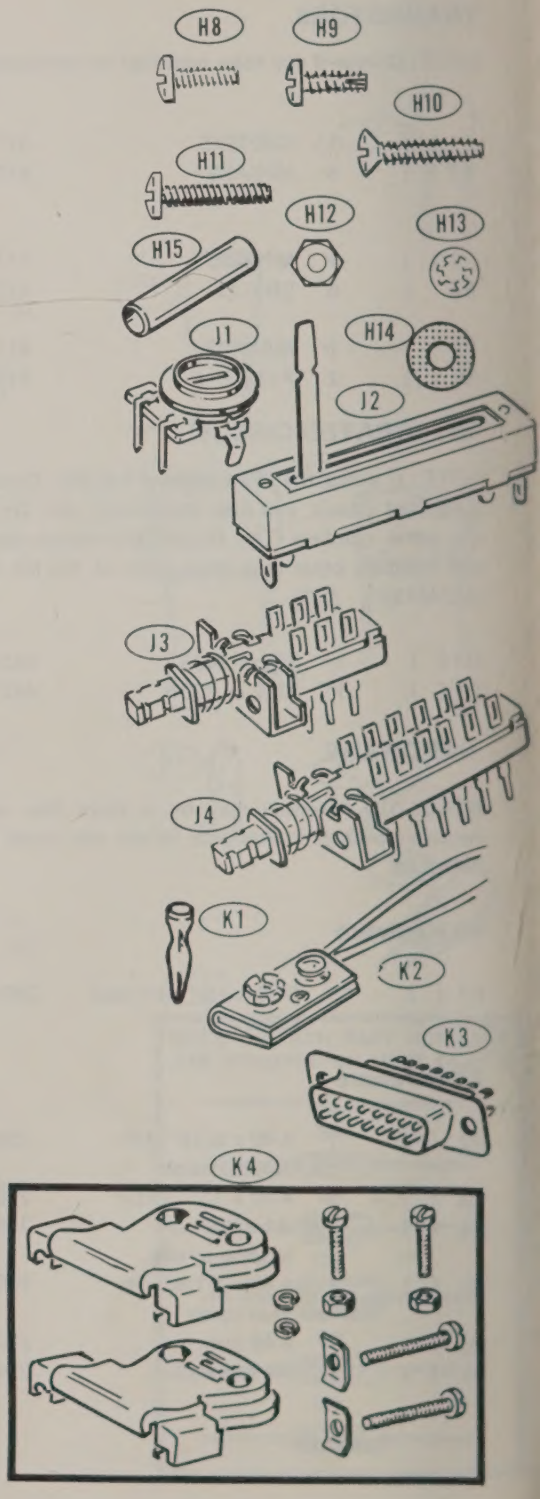
H1 ( )	2	3-56 x 1/8" pan-head screw	250-354

#4 Hardware

H2 ( )	1	4-40 x 5/16" self-tapping screw	250-163
H3 ( )	3	4-40 x 1/2" screw	250-34
H4 ( )	2	#4 x 3/8" self-tapping screw	250-186
H5 ( )	4	4-40 x 1-1/4" pan head screw	250-226
H6 ( )	7	4-40 nut	252-2
H7 ( )	7	#4 lockwasher	254-9



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
#6 Hardware				
H8 ( )	3	6-32 x 3/8" pan head screw	250-89	
H9 ( )	4	#6 x 3/8" self-tapping screw	250-592	
H10 ( )	5	#6 x 5/8" self-tapping screw	250-559	
H11 ( )	1	6-32 x 5/8" pan head screw	250-26	
H12 ( )	4	6-32 nuts	252-3	
H13 ( )	4	#6 lockwasher	254-1	
H14 ( )	3	#6 fiber washer	253-35	
H15 ( )	4	3/4" metal spacer	255-5	
CONTROL-SWITCHES				
J1 ( )	1	20 kΩ control	10-388	R7
J2 ( )	1	25 kΩ slide control	10-1057	R29
J3 ( )	1	6-lug switch	64-85	SW2
J4 ( )	1	12-lug switch	64-788	SW1
CONNECTORS				
K1 ( )	4	Connector (2 extra)	432-134	
K2 ( )	1	Battery connector	432-798	
K3 ( )	1	Phone connector	432-890	
K4 ( )	1	Connector shells with hardware	432-891	



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.

SOCKETS-JACK-PLUGS-KNOBS

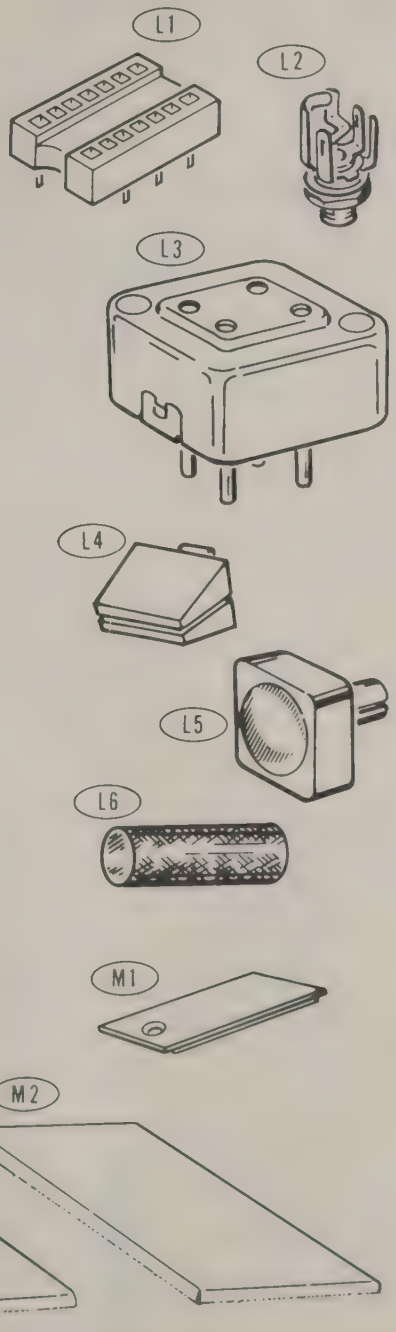
L1 ( )	2	Integrated circuit socket	434-267
L2 ( )	1	Jack (w/washer & nut)	436-28
L3 ( )	1	4-prong plug	438-51
L4 ( )	1	Slide control knob	462-917
L5 ( )	2	Pushbutton knob	462-966

WIRE-CABLE-SLEEVING

( )	1	Black wire (4')	344-50
( )	1	Red wire (4')	344-52
( )	1	White wire (2')	344-59
( )	1	4-wire cable (7')	347-7
L6 ( )	1	Fiber tubing (1-1/4")	346-6

CABINET PARTS

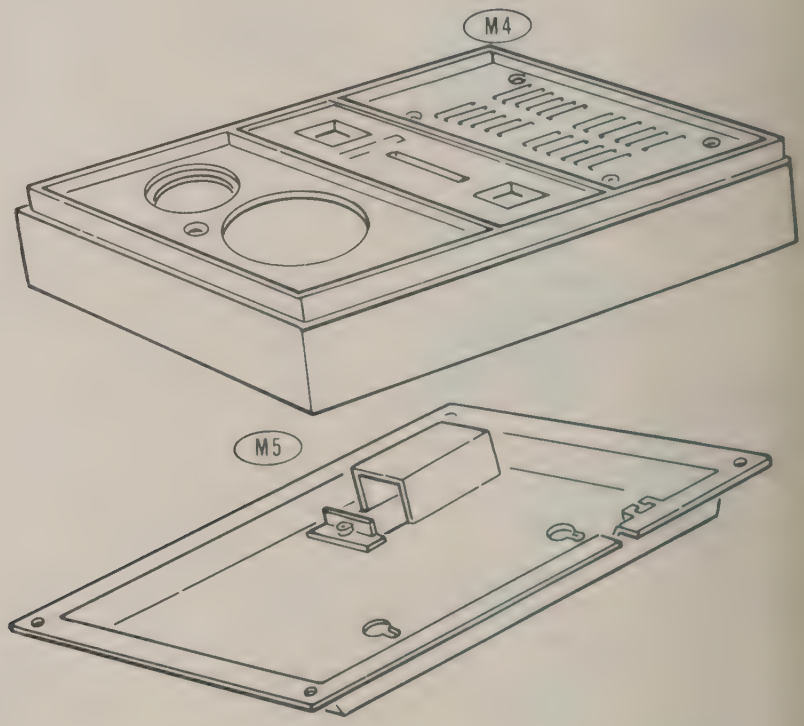
M1 ( )	1	Access lid	95-603
M2 ( )	1	Speaker grille and dial grille set	92-634



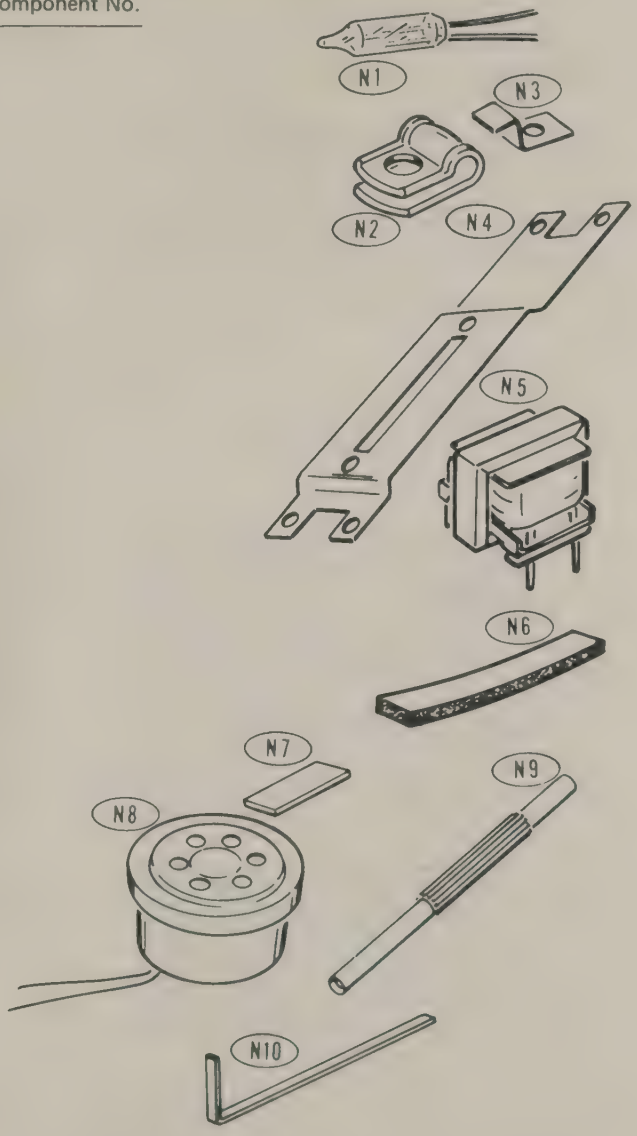
KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.

Cabinet Parts (cont'd.)

M4	( )	1	Cabinet	95-601
M5	( )	1	Cabinet bottom	95-602



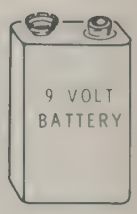
KEY No.		QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
MISCELLANEOUS					
N1	( )	1	Neon lamp	412-36	
N2	( )	1	Plastic cable clamp	207-3	
N3	( )	2	Microphone bracket	204-2150	
N4	( )	1	Control bracket	204-2113	
N5	( )	1	Transformer	51-189	
N6	( )	2	Gasket (5")	73-92	
N7	( )	4	Insulator pads	75-138	
N8	( )	1	Microphone	480-70	
	( )	1	Speaker	401-162	
	( )	1	Dialer	100-1670	
N9	( )	1	Plastic nut starter	490-5	
N10	( )	1	Integrated circuit puller	490-111	
	( )	1	Circuit board	85-1872-2	
	( )	1	Blue and white label	391-34	
	( )	1	Parts Order Form	597-260	
	( )	1	Kit Builders Guide	597-308	
	( )	1	Manual (See front cover for part number.)		
	( )		Solder		



BATTERY

You should purchase the following battery at this time for use in your kit:

One 9-volt transistor battery, NEDA #1604. Representative manufacturers and their type numbers are:



Eveready #216, PP3

Burgess #2V6

Mallory #TR-146X (long life)

RCA #VS323

Hellesens #410

Varta #438

CEI #6F22

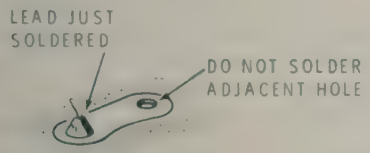
Ray-O-vac #D1604 or #D1604-1

IMPORTANT ASSEMBLY NOTES

1. Before you start to assemble this kit, read the wiring, soldering, and step-by-step information in the "Kit Builders Guide."

2. Due to the small area between foils on the circuit board, you should use the utmost care to prevent solder bridges between adjacent foil areas. Use only a minimum amount of solder and do not heat components excessively with the soldering iron. Use no larger than a 35-watt soldering iron with a small tip. Allow it to reach operating temperature, and then apply it only long enough to make a good solder connection.

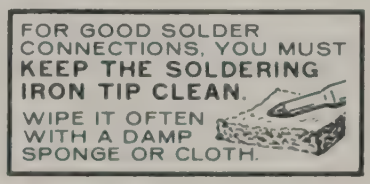
3. Do not solder empty holes in the foil that may be adjacent to a component lead you are about to solder.



4. Use the following procedure when you install parts on the circuit board.

   A. Insert six or less components unless instructed otherwise.

   B. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths. To further illustrate this procedure, turn momentarily to Page 14. Note the column of steps on each side of the Pictorial and observe that there are no soldering instructions except for a reminder at the end of each column. Therefore, use your discretion as to the number of parts you want to install. If you install too many, the foil side could become crowded with leads, which makes them difficult to solder.



5. SAFETY WARNING: Avoid eye injury when you clip off excess leads. Clip the leads so the ends will not fly toward your eyes.

6. A separate "Illustration Booklet" contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. The Step-by-Step Assembly instructions will direct you to the proper illustration in the Booklet. The illustrations are arranged in Pictorial number sequence. Place the Booklet in a convenient location and keep it with the Assembly Manual.

STEP-BY-STEP ASSEMBLY

CIRCUIT BOARD

START

NOTES:

1. Throughout these Pictorials, the circuit board is always positioned so the part number, 85-1872-2 (on the component side) is at the top. In some of the Pictorials, such as the following, only half of the board is shown so both sides of the page can be utilized for steps.
2. The following resistors are called out by their resistance value in Ω, kΩ, or MΩ, and color code.

( ) R57: 39 kΩ (orange-white-orange).

( ) R61: 120 kΩ (brown-red-yellow).

( ) R45: 120 kΩ (brown-red-yellow).

( ) R44: 82 kΩ (gray-red-orange). IMPORTANT NOTE: Screen may be marked "270K."

( ) R46: 1.5 MΩ (brown-green-green).

( ) R49: 1.5 MΩ (brown-green-green).

( ) R47: 10 kΩ (brown-black-orange).

( ) R48: 10 MΩ (brown-black-blue).

( ) R51: 470 kΩ (yellow-violet-yellow).

( ) R54: 120 kΩ (brown-red-yellow).

( ) R8: 22 kΩ (red-red-orange).

( ) R3: 6800 Ω (blue-gray-red).

( ) R2: 39 kΩ (orange-white-orange).

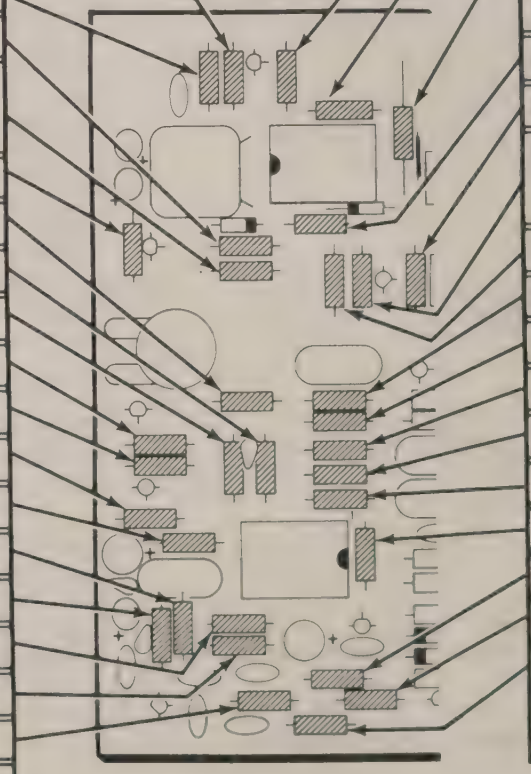
( ) R1: 3.3 MΩ (orange-orange-green).

( ) R5: 470 kΩ (yellow-violet-yellow).

( ) R4: 39 kΩ (orange-white-orange).

( ) R9: 68 kΩ (blue-gray-orange).

( ) Make sure all leads are soldered and the excess lead lengths cut off.

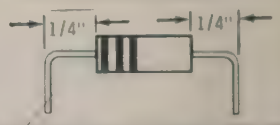


CONTINUE

( ) R58: 120 kΩ (brown-red-yellow).

( ) R59: 39 kΩ (orange-white-orange).

( ) R56: 1000 Ω (brown-black-red). Bend the leads as shown.



( ) R53: 470 kΩ (yellow-violet-yellow).

( ) R43: 120 kΩ (brown-red-yellow).

( ) R52: 120 kΩ (brown-red-yellow). IMPORTANT NOTE: Screen may be marked "270K."

( ) R42: 120 kΩ (brown-red-yellow).

( ) R27: 3900 Ω (orange-white-red).

( ) R24: 220 kΩ (red-red-yellow).

( ) R23: 100 kΩ (brown-black-yellow).

( ) R25: 100 kΩ (brown-black-yellow).

( ) R26: 220 kΩ (red-red-yellow).

( ) R76: 120 kΩ (brown-red-yellow).

( ) R11: 120 kΩ (brown-red-yellow).

( ) R13: 22 Ω (red-red-black).

( ) R6: 3900 Ω (orange-white-red).

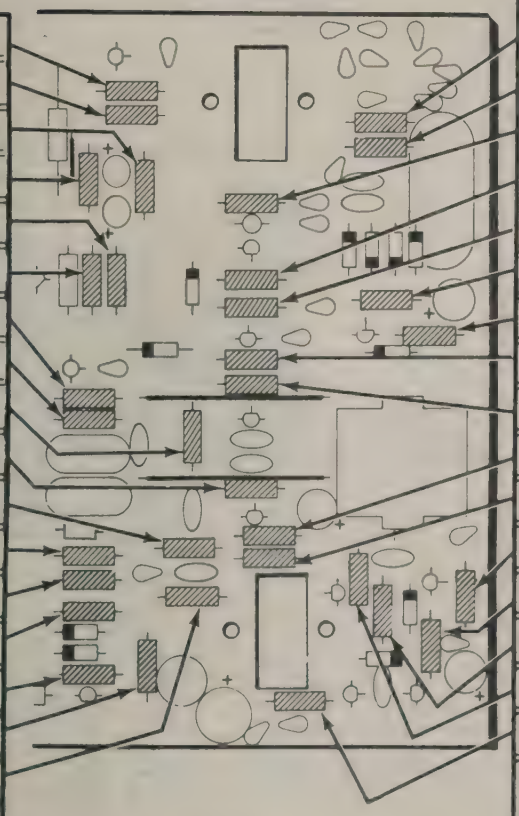
( ) Make sure all leads are soldered and the excess lead lengths cut off.

PICTORIAL 1-1

KEEP YOUR SOLDERING IRON TIP CLEAN

START

- ( ) R63: 68 kΩ (blue-gray-orange).
- ( ) R64: 39 kΩ (orange-white-orange).
- ( ) R55: 39 kΩ (orange-white-orange).
- ( ) R62: 39 kΩ (orange-white-orange).
- ( ) R41: 2200 Ω (red-red-red).
- ( ) R39: 270 kΩ (red-violet-yellow).
- ( ) R28: 3300 Ω (orange-orange-red).
- ( ) R15: 820 Ω (gray-red-brown).
- ( ) R66: 39 kΩ (orange-white-orange).
- ( ) R67: 1.5 MΩ (brown-green-green).
- ( ) R31: 120 kΩ (brown-red-yellow).
- ( ) R17: 820 Ω (gray-red-brown).
- ( ) R14: 820 Ω (gray-red-brown).
- ( ) R75: 120 kΩ (brown-red-yellow).
- ( ) R12: 10 kΩ (brown-black-orange).
- ( ) R16: 220 kΩ (red-red-yellow).
- ( ) R65: 270 kΩ (red-violet-yellow).
- ( ) Make sure all leads are soldered and the excess lead lengths cut off.



PICTORIAL 1-2

CONTINUE

NOTE: As you install the next three resistors, pay close attention to the third color band.

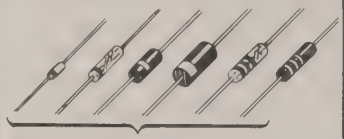
- ( ) R22: 22 Ω (red-red-black).
- ( ) R21: 22 Ω (red-red-black).
- ( ) R74: 22 kΩ (red-red-orange).
- ( ) R72: 10 kΩ (brown-black-orange).
- ( ) R71: 10 kΩ (brown-black-orange).
- ( ) R18: 6800 Ω (blue-gray-red).
- ( ) R19: 82 Ω (gray-red-black).
- ( ) R69: 39 kΩ (orange-white-orange).
- ( ) R68: 1.5 MΩ (brown-green-green).
- ( ) R32: 270 kΩ (red-violet-yellow).
- ( ) R33: 1000 Ω (brown-black-red).
- ( ) R38: 2200 Ω (red-red-red).
- ( ) R37: 4.7 Ω (yellow-violet-gold).
- ( ) R36: 10 kΩ (brown-black-orange).
- ( ) R35: 560 Ω (green-blue-brown).
- ( ) R34: 6800 Ω (blue-gray-red).
- ( ) Make sure all leads are soldered and the excess lead lengths cut off.

Set aside the three remaining resistors. These are an 82 Ω (gray-red-black), a 220 Ω (red-red-brown), and a 560 Ω (green-blue-brown).

KEEP YOUR SOLDERING IRON TIP CLEAN

START

NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. ALWAYS POSITION THE BANDED END AS SHOWN ON THE CIRCUIT BOARD.



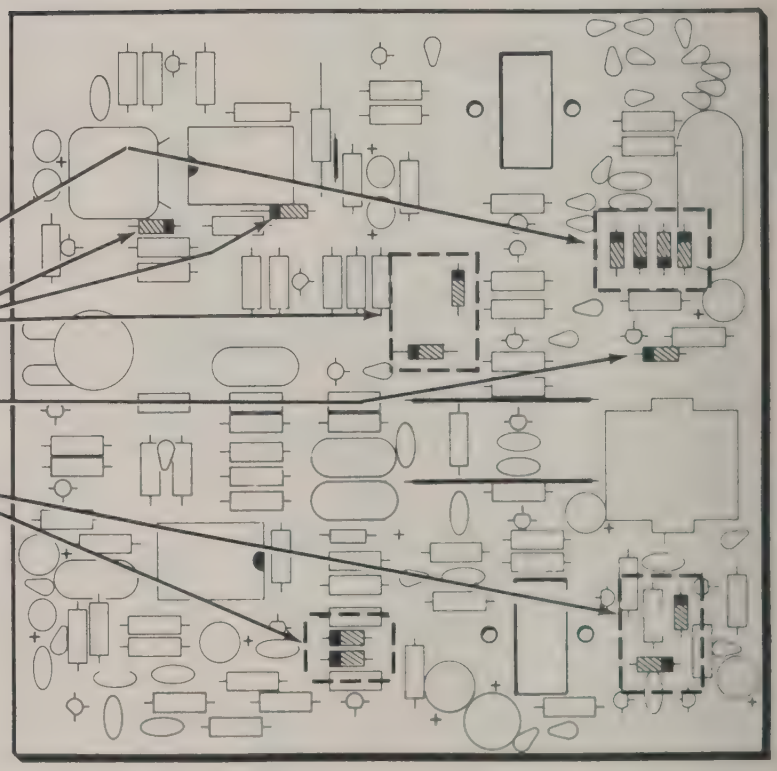
( ) D5, D6, D7, D8: Four 1N4002 silicon diodes (#57-65).

( ) D13, D14, D15, D16: Four 1N4149 silicon diodes (#56-56).

( ) ZD9: One 1N4166A zener diode (#56-25).

( ) D1, D2, D11, D12: Four 1N4148 silicon diodes (#56-84).

( ) Make sure all leads are soldered and the excess lead lengths cut off.

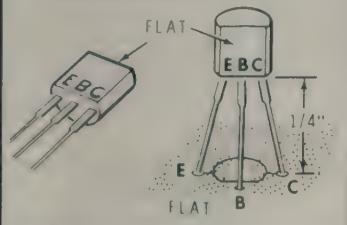


PICTORIAL 2-1

START

NOTE: In the following steps, install each of the transistors as follows:

1. Refer to the illustration example below and identify the E, B, and C leads of the transistor.
2. Bend the B lead of each transistor toward the flat.
3. Insert the transistor leads into the corresponding E, B, and C holes in the circuit board.
4. Position the transistor approximately 1/4" above the circuit board.
5. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.



(✓) Locate eight MPSA20 transistors (#417-801).

(✓) Q16.

(✓) Q15.

(✓) Q14.

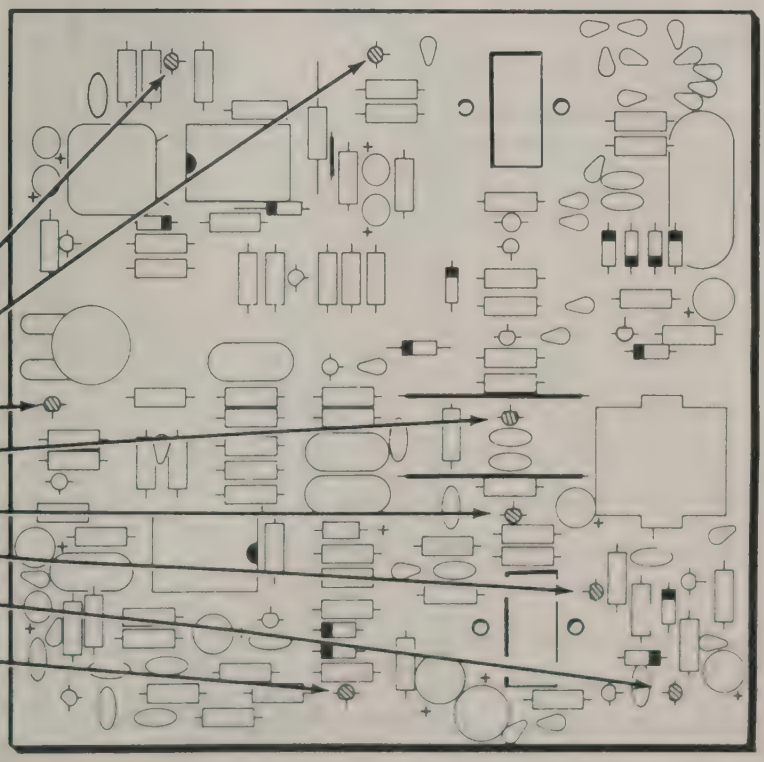
(✓) Q18.

(✓) Q17.

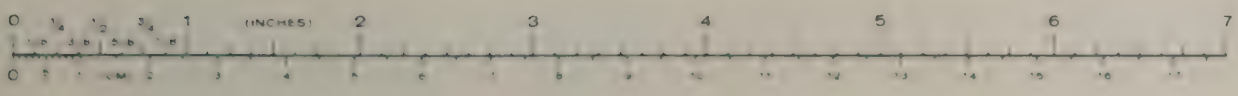
(✓) Q7.

(✓) Q9.

(✓) Q3.



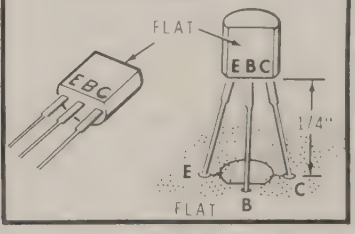
PICTORIAL 3-1



Detail 3-2A

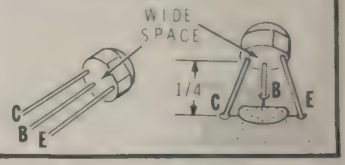
NOTE: In the following steps, install each of the transistors as follows:

1. Refer to the illustration example below and identify the E, B, and C leads of the transistor.
2. Bend the B lead of each transistor toward the flat.
3. Insert the transistor leads into the corresponding E, B, and C holes in the circuit board.
4. Position the transistor approximately 1/4" above the circuit board.
5. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.



NOTE: In the following steps, install each of the transistors as follows:

1. Refer to the illustration example below and identify the E, B, and C leads of the transistor.
2. Insert the transistor leads into the corresponding E, B, and C holes in the circuit board.
3. Position the transistor approximately 1/4" above the circuit board.
4. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.

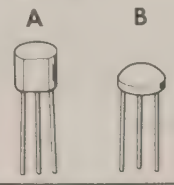


Detail 3-2B

START

( ) Locate six 2N4121 transistors (#417-235).

NOTE: These transistors could be supplied in two different shapes as in "A" and "B" below. If they are shaped as in "A," refer to Detail 3-2A for the installation instructions. If they are shaped as in "B," refer to Detail 3-2B.



( ) Q13.

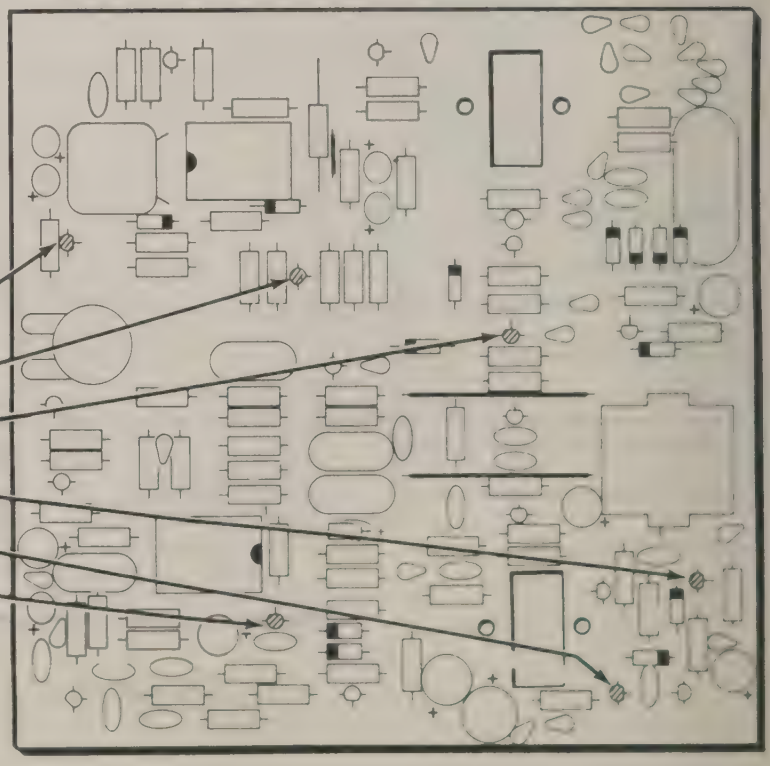
( ) Q12.

( ) Q19.

( ) Q11

( ) Q8

( ) Q4



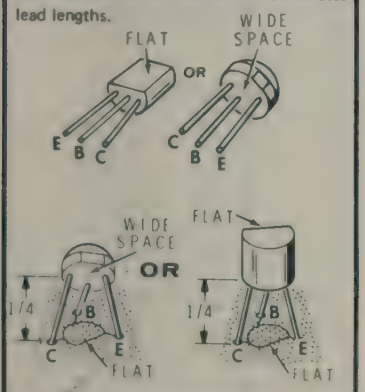
PICTORIAL 3-2

KEEP YOUR SOLDERING IRON TIP CLEAN

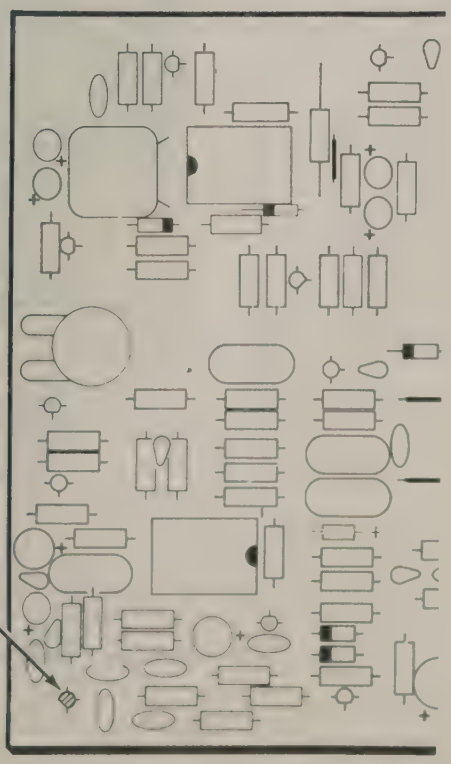
START

Locate the SM07275 transistor (#417-283).

NOTE: This transistor may be either one of the two case styles shown below. Note that the E, B, and C leads are not in the same order on both styles. Refer to the illustration below and identify the E, B, and C leads on the transistor you received. Then insert the leads into their correct E, B, and C holes in the circuit board. Solder the leads to the foil and cut off the excess lead lengths.



Q1.



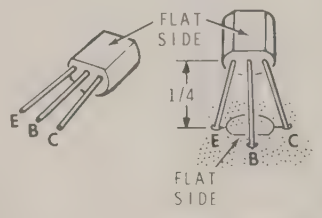
PICTORIAL 3-3

START

(1) Locate the MPSA05 transistor (#417-864).

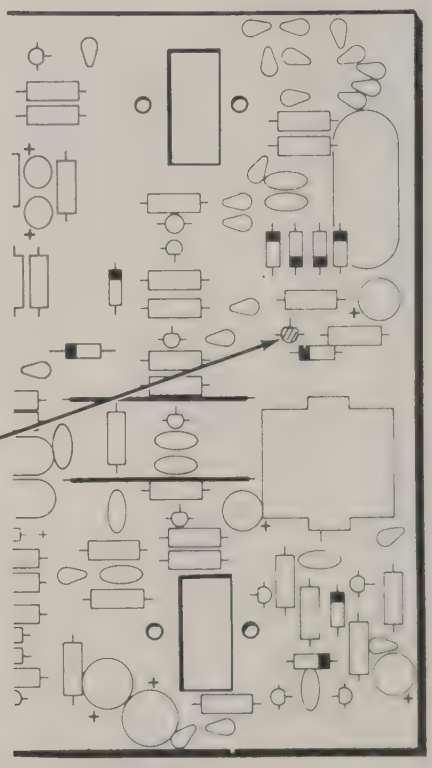
NOTE: In the following step, install the transistor as follows:

1. Refer to the illustration example below and identify the E, B, and C leads of the transistor.
2. Bend the B lead of the transistor toward the flat.
3. Insert the transistor leads into the corresponding E, B, and C holes in the circuit board.
4. Position the transistor approximately 1/4" above the circuit board.
5. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.



(2) Q5.

KEEP YOUR SOLDERING IRON TIP CLEAN

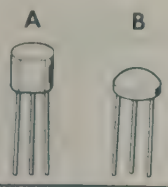


PICTORIAL 3-4

START

( ) Locate the two P1087E transistors (#417-858).

NOTE: These transistors could be supplied in two different shapes as in "A" and "B" below. If they are shaped as in "A," refer to Detail 3-5A for the installation instructions. If they are shaped as in "B," refer to Detail 3-5B.

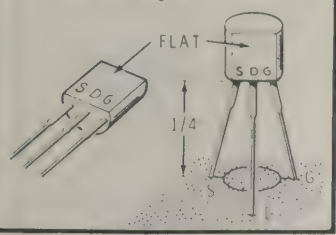


( ) Q6

( ) Q2

NOTE: In the following steps, install each of the transistors as follows:

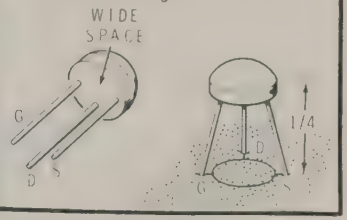
1. Refer to the illustration example below and identify the S, D, and G leads of the transistor.
2. Bend the D lead of each transistor toward the flat.
3. Insert the transistor leads into the corresponding S, D, and G holes in the circuit board.
4. Position the transistor approximately 1/4" above the circuit board.
5. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.



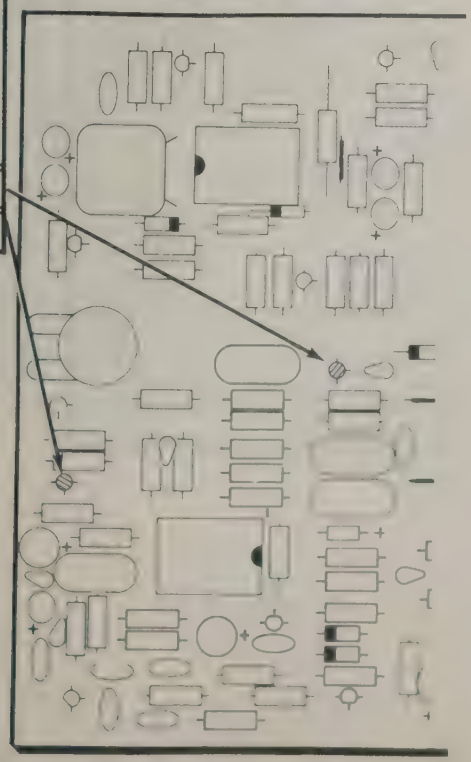
Detail 3-5A

NOTE: In the following steps, install each of the transistors as follows:

1 Refer to the illustration example below and identify the G, D, and S leads of the transistor.
2. Insert the transistor leads into the corresponding G, D, and S holes in the circuit board.
3. Position the transistor approximately 1/4" above the circuit board.
4 Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths.



Detail 3-5B



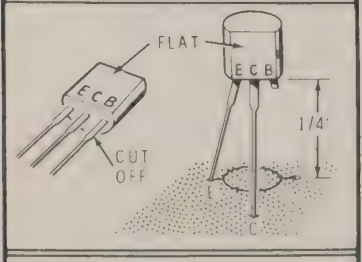
PICTORIAL 3-5

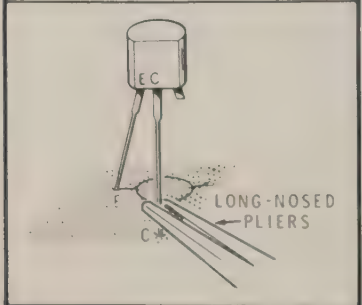
START

( ) Locate the MRD14B transistor (#417-859).

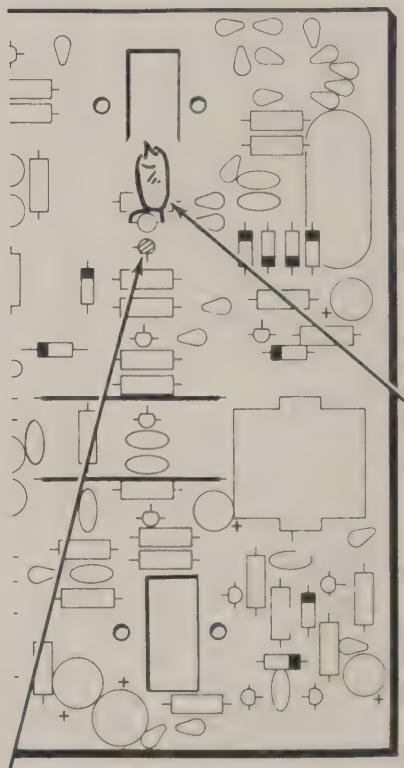
NOTE: In the following step, install the transistor as follows:

1. Refer to the illustration example below and identify the E, C, and B leads of the transistor.
2. Bend the C lead of the transistor toward the flat.
3. Cut the B lead off at the base of the transistor.
4. Insert the transistor leads into the corresponding E and C holes in the circuit board.
5. Position the transistor 1/4" above the circuit board. This dimension should be quite accurate.
6. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths. NOTE: Since this transistor is susceptible to heat, it will be necessary to hold each lead with a pair of long-nosed pliers while you solder so the heat will be absorbed. The pliers can be held on the lead by wrapping a rubber band around the handles so your hands are free to solder.





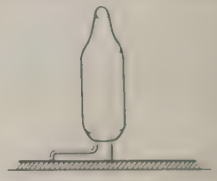
( ) Q21.

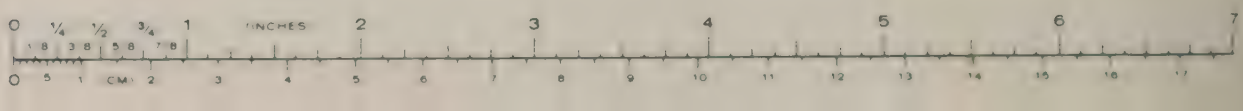


PICTORIAL 3-6

CONTINUE

( ) NE2: Install the neon lamp. Because of the way the leads exit from the lamp, it is necessary to position the lamp as shown. Solder the leads to the foil and cut off the excess lengths.





KEEP YOUR SOLDERING IRON TIP CLEAN

START

NOTES:

1. Capacitors will be called out by their capacitance values (in pF or μF) and type (Mylar, disc, tantalum electrolytic, or electrolytic).

2. The leads of Mylar capacitors may be coated with a clear film. If you have any soldering problem with these capacitors, apply more heat to the leads to melt this film.

( ) C30 .01 μF disc.

( ) C28: .1 μF Mylar. Install this capacitor as shown. IMPORTANT NOTE: Screen may be marked ".22."

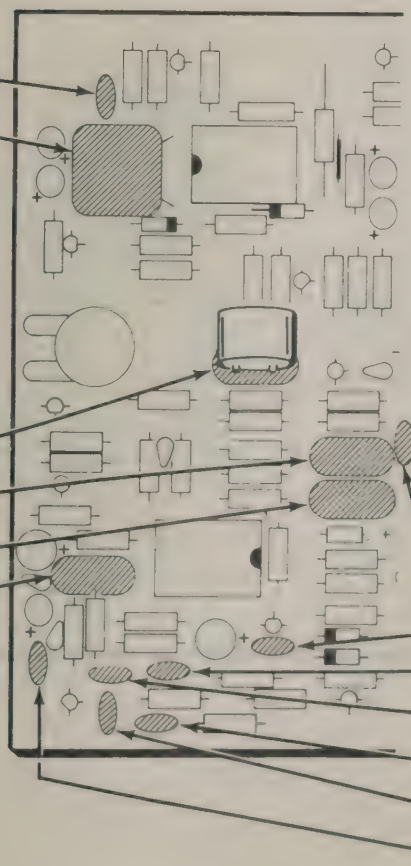
( ) C19: .1 μF Mylar. Bend this capacitor over against the two resistors. This is to keep it from interfering with the dialer in the final assembly.

( ) C17: .1 μF Mylar.

( ) C18 1 μF Mylar

( ) C7 1 μF Mylar

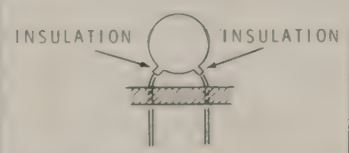
( ) Make sure all leads are soldered and the excess lead lengths cut off.



PICTORIAL 4-1

CONTINUE

NOTE: When you install disc capacitors, do not push the insulated portions of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



( ) C16 .01 μF disc

( ) C9 500 pF disc

( ) C6 100 pF disc

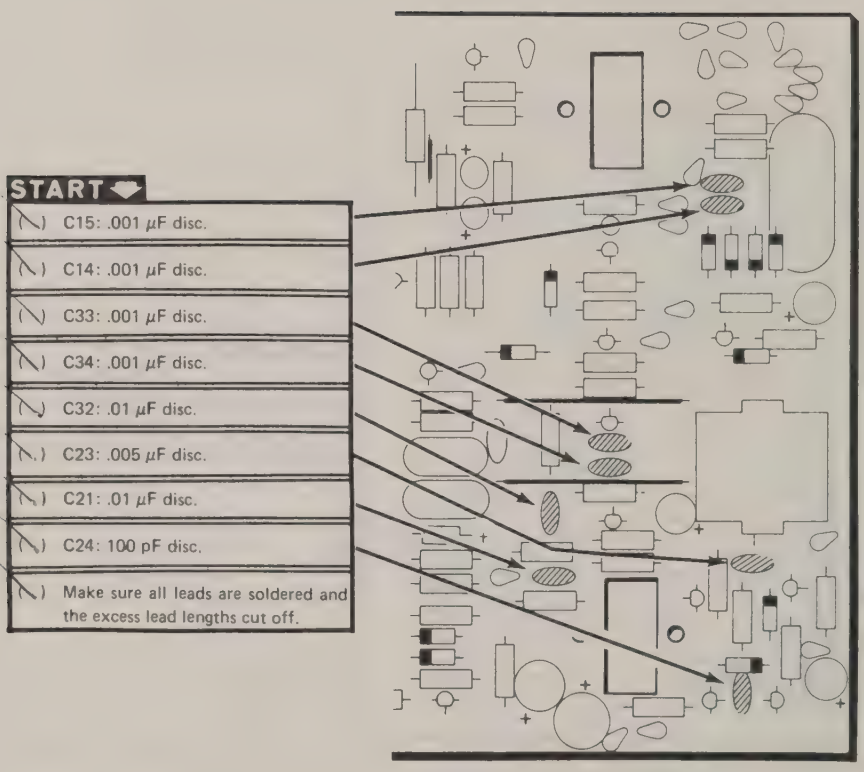
( ) C5: .005 μF disc.

( ) C8: .005 μF disc

( ) C4 500 pF disc

( ) C3 .01 μF disc

( ) Make sure all leads are soldered and the excess lead lengths cut off.


START
C15: .001 μF disc.
C14: .001 μF disc.
C33: .001 μF disc.
C34: .001 μF disc.
C32: .01 μF disc.
C23: .005 μF disc.
C21: .01 μF disc.
C24: 100 pF disc.
Make sure all leads are soldered and the excess lead lengths cut off.

PICTORIAL 4-2

KEEP YOUR SOLDERING IRON TIP CLEAN

START

NOTE: When you install each of the following tantalum electrolytic capacitors, be sure to position the plus (+) marked or dot (•) marked lead in the plus (+) marked hole.

( ) C26 68 µF

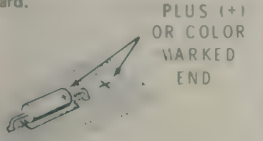
( ) C27 68 µF

( ) C29 68 µF

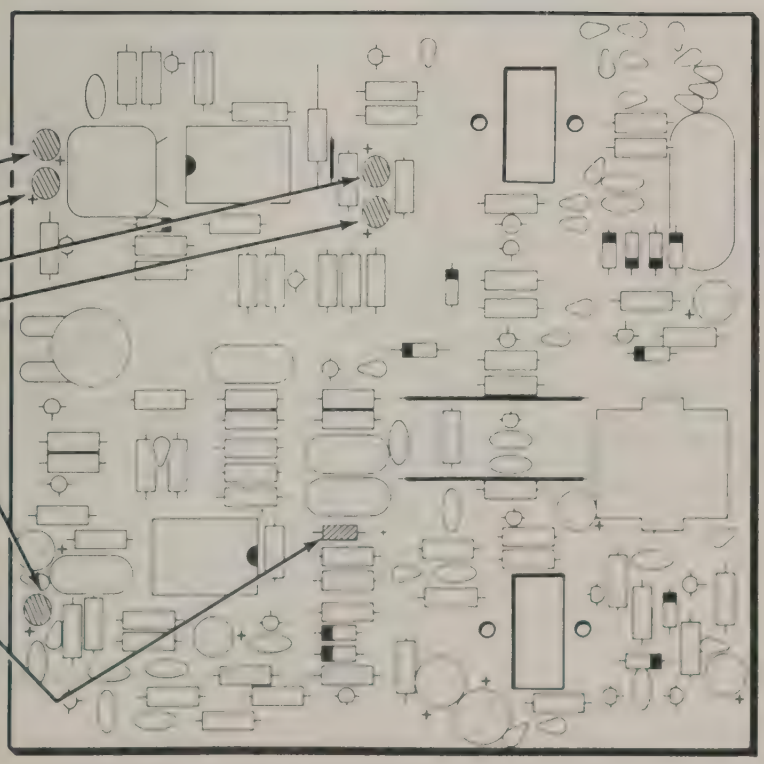
( ) C31 68 µF

( ) C1 68 µF

( ) C10: 1 µF tantalum. Be sure to position the plus (+) or color marked end as shown on the circuit board.



( ) Make sure all leads are soldered and the excess lead lengths cut off.

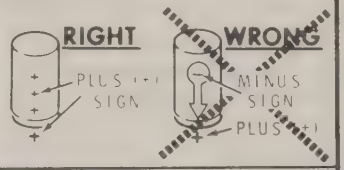


PICTORIAL 4-3

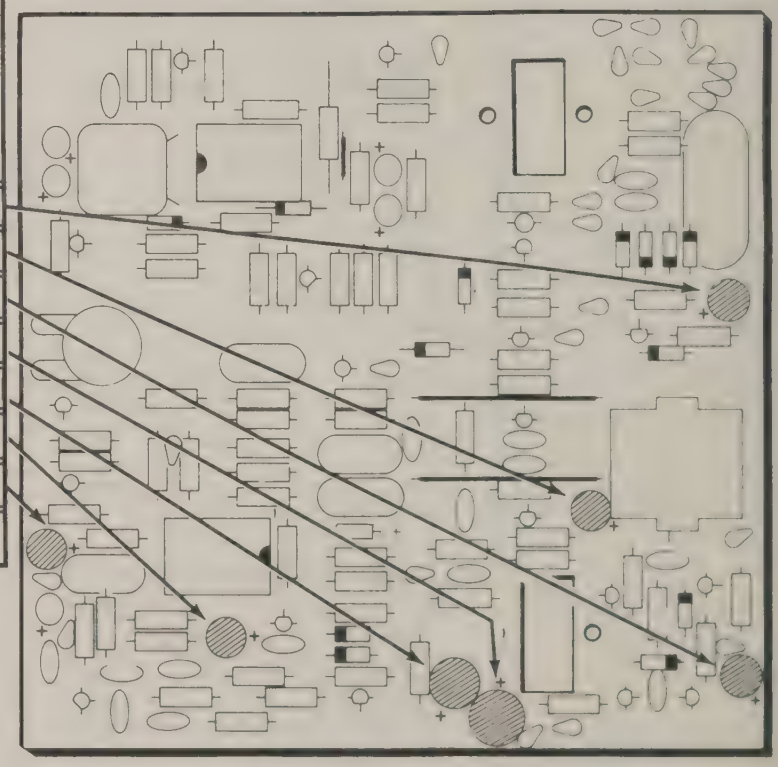
KEEP YOUR SOLDERING IRON TIP CLEAN

START

NOTE: When you install electrolytic capacitors, be sure to position the positive (+) lead of the capacitor toward the positive (+) mark on the circuit board. Disregard any minus (—) markings on the capacitor.



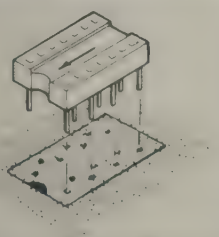
- ( ) C13: 10 μF.
- ( ) C22: 10 μF.
- ( ) C25: 10 μF.
- ( ) C37: 100 μF.
- ( ) C11: 10 μF.
- ( ) C36: 10 μF.
- ( ) C2: 10 μF.
- ( ) Make sure all leads are soldered and the excess lead lengths cut off.



PICTORIAL 4-4

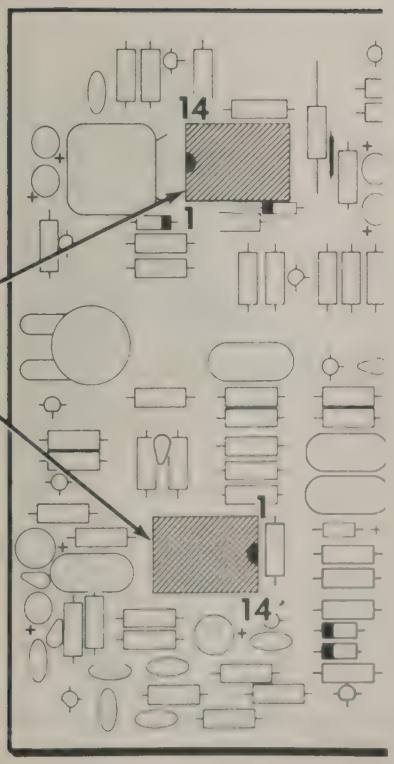
START

NOTE: The integrated circuit sockets can only be installed one way. Make sure the pins are straight. Then match up the pins with the holes in the circuit board and install the socket. Solder the pins to the foil. Make sure none of the pins bend as you insert them.



( ) Integrated circuit socket at IC2. .

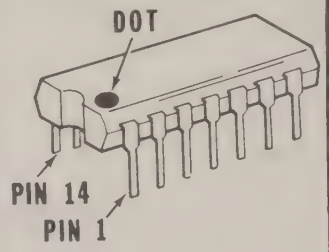
( ) Integrated circuit socket at IC1.

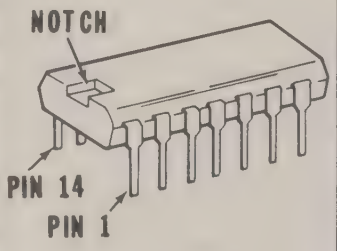


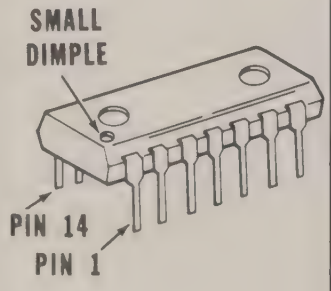
PICTORIAL 5-1

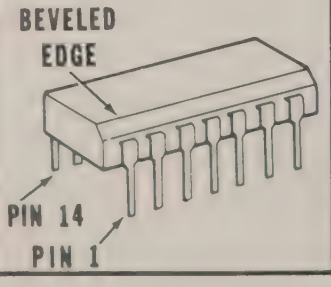
START

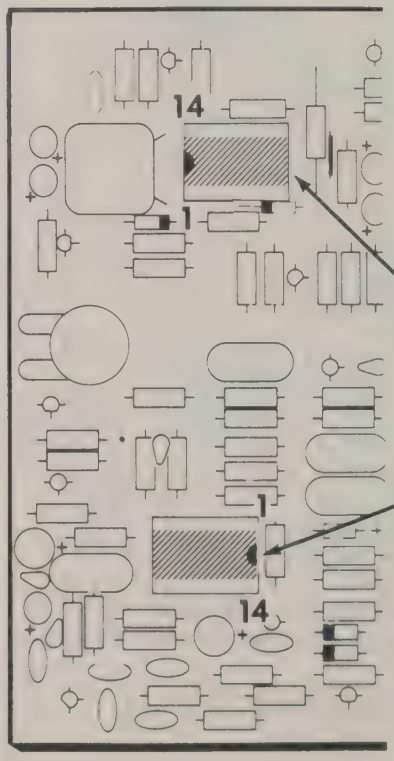
NOTE: Integrated circuits can be marked in any one of the ways shown below: a dot, or a notch, or a small dimple, or a beveled edge. This marked end identifies pin 1 and pin 14 of an integrated circuit.





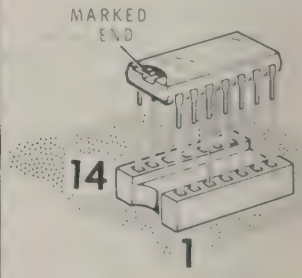




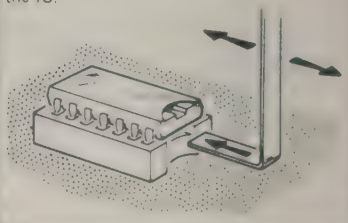


CONTINUE

Make sure the pins are straight. Then install each integrated circuit by matching the marked end with holes 1 and 14 on the circuit board. Then carefully insert the pins into the socket.



Should it ever become necessary to remove an IC from its socket, use the IC puller supplied with your kit. To use the puller, insert its foot beneath the IC; then gently rock the tool back and forth to lift the IC.



( ) IC2: 3302 integrated circuit (#442-616).

( ) IC1: 324 integrated circuit (#442-602).

PICTORIAL 5-2

KEEP YOUR SOLDERING IRON TIP CLEAN

START

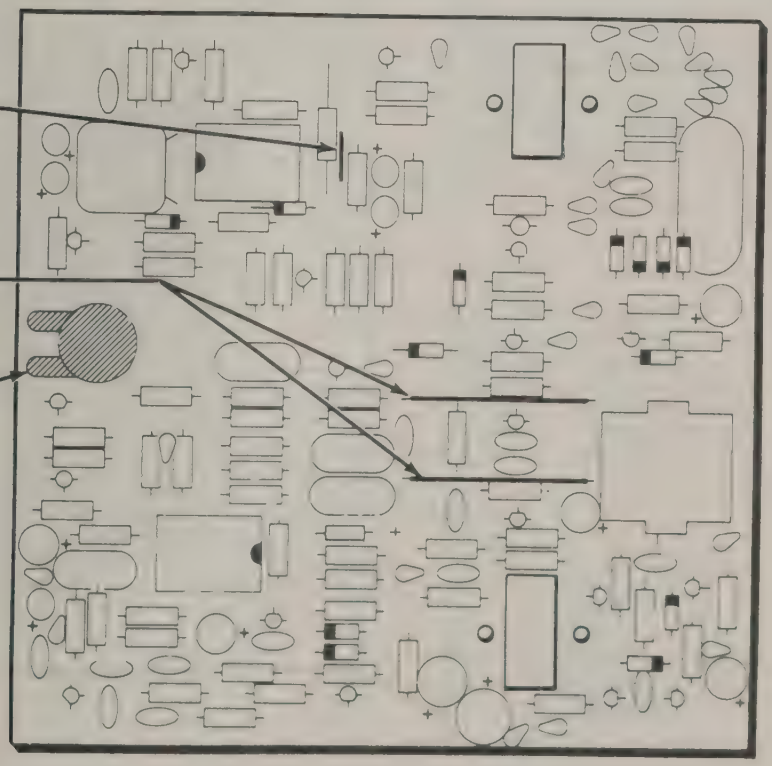
( ) 1" bare wire. You may use a discarded resistor lead for this wire.

NOTE: Whenever you are instructed to connect a wire, cut it to the specified length and remove 1/4" of insulation from each end.

( ) Two 1-7/8" black wires.

( ) Solder the wires to the foil and cut off any excess lengths.

( ) R7: 20 kΩ control (#10-388). Solder the four lugs to the foil.



PICTORIAL 5-3

KEEP YOUR SOLDERING IRON TIP CLEAN

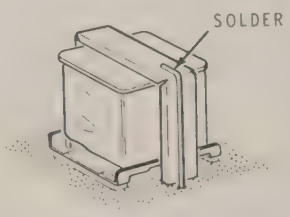
START

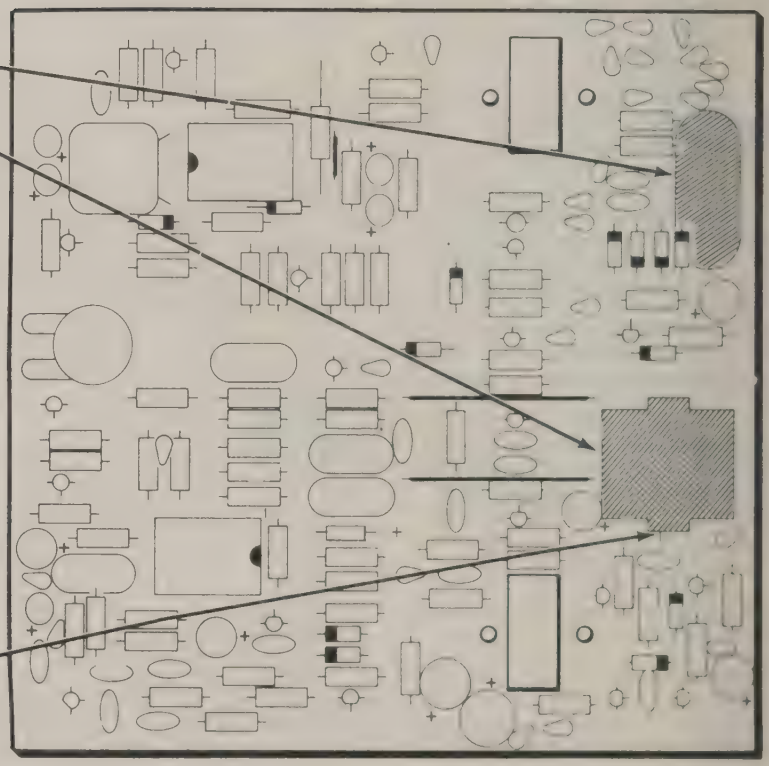
( ) C12: 2.2 μF Mylar capacitor.

( ) T1: Transformer (#51-189). Solder the four lugs to the foil. NOTE: This transformer can be installed either way.

( ) Remove all of the insulation from a 1-1/2" black wire. Form the wire as shown.

( ) Insert the wire into the hole next to the transformer so that the short L is resting on the metal housing of the transformer. Solder this end to the housing and the other end to the foil. Cut off the excess wire from the foil side.



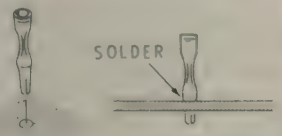


PICTORIAL 5-4

START

Reposition the circuit board so the foil side is up and the Part Number 85-1669 is to your left as shown.

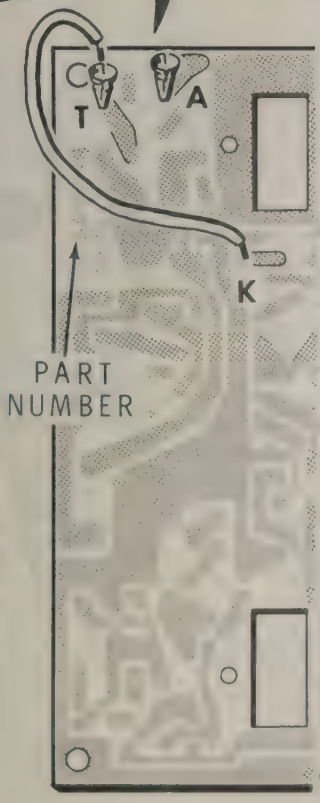
To install the following connectors, insert them into the circuit board until they are just snug. Then solder them to the foil. Be careful not to fill the connector with solder. Note that two extra connectors were supplied if this should happen.



( ) Connector in hole T. See the inset.

( ) Connector in hole A. See the inset.

( ) 2-1/2" white wire in hole K. Leave about 1/8" of bare wire exposed, and then solder it to the foil. Insert the other end of the wire into connector T, but do not solder it.



CIRCUIT BOARD CHECKOUT

IMPORTANT: Perform the following checkout procedure before you proceed with the wiring.

Visual Inspection

Carefully inspect the foil side of the circuit board for the following most commonly made errors. Review Pages 10 and 11 of your "Kit Builders Guide" to remedy these problems, if any exist.

( ) Unsoldered connections. This does not apply to empty holes that should not be soldered at this time.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

As you make the following visual checks, refer to the Pictorial where the part was installed and check it against the installation instructions.

( ) Check each diode for the proper type and direction of the banded end.

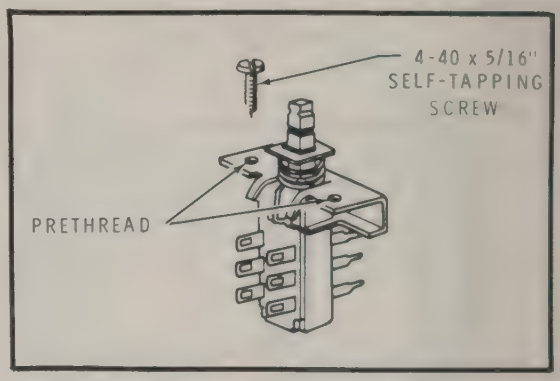
( ) Check each electrolytic and tantalum capacitor for the correct position of the plus (+) lead.

( ) Check each transistor for the proper type and installation.

( ) Check each integrated circuit for the proper type and installation.

PICTORIAL 5-5

KEEP YOUR SOLDERING IRON TIP CLEAN



Detail 6-1A

START

( ) Refer to Detail 6-1A and prethread the two mounting holes in the 6-lug and 12-lug switches. Use a 4-40 x 5/16" self-tapping screw. Turn the screw in all the way, and then out. Do this carefully so the screwdriver does not slip and damage the switch.

NOTE: In the wiring steps, (NS) means not to solder because other wires will be added later. "S–" with a number, such as (S-1), means to solder the connection. The number following the "S" tells how many wires are at the connection.

( ) Prepare the following black wires:

1" 3-3/4"

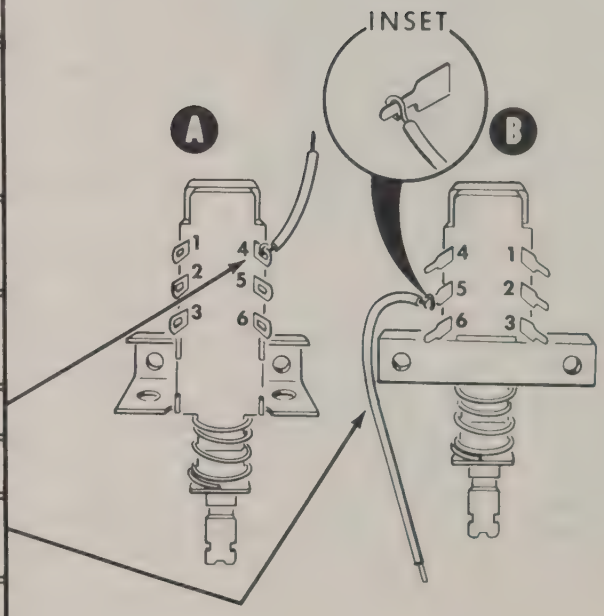
( ) Position the 6-lug switch so the lugs with the holes are toward you as in Part A. Note the lug numbering.

( ) 1" wire to lug 4 (S-1).

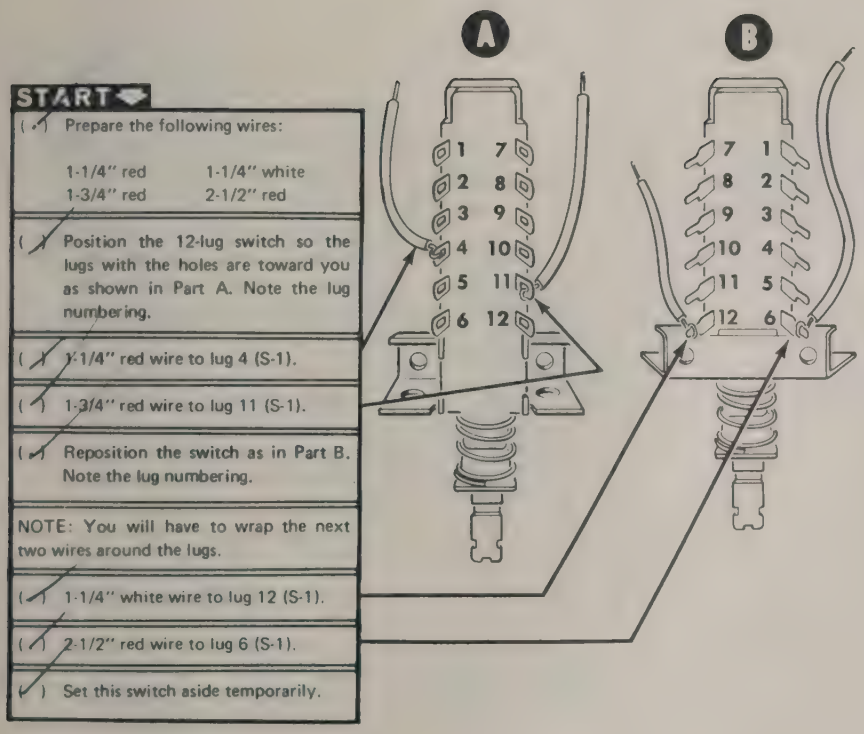
( ) Reposition the switch as in Part B. Note the lug numbering.

( ) 3-3/4" wire to lug 5 (S-1). You will have to wrap the wire around this lug. See the inset drawing.

Set this switch aside temporarily.

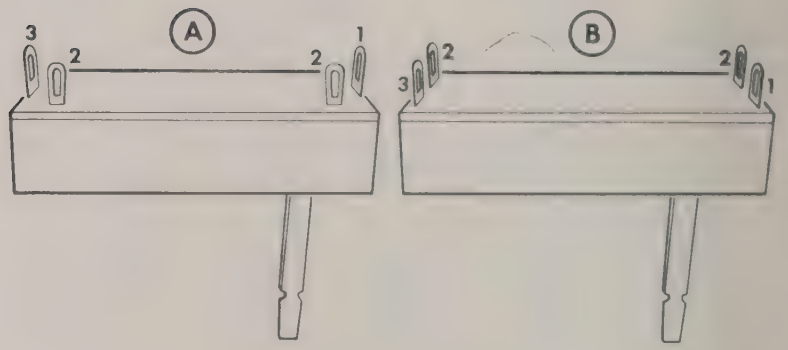


PICTORIAL 6-1


A
B
START
( ) Prepare the following wires:
1-1/4" red
1-1/4" white
1-3/4" red
2-1/2" red
( ) Position the 12-lug switch so the lugs with the holes are toward you as shown in Part A. Note the lug numbering.
( ) 1-1/4" red wire to lug 4 (S-1).
( ) 1-3/4" red wire to lug 11 (S-1).
( ) Reposition the switch as in Part B. Note the lug numbering.
NOTE: You will have to wrap the next two wires around the lugs.
( ) 1-1/4" white wire to lug 12 (S-1).
( ) 2-1/2" red wire to lug 6 (S-1).
( ) Set this switch aside temporarily.
1 7
2 8
3 9
4 10
5 11
6 12
7 1
8 2
9 3
10 4
11 5
12 6

PICTORIAL 6-2

KEEP YOUR SOLDERING IRON TIP CLEAN



START

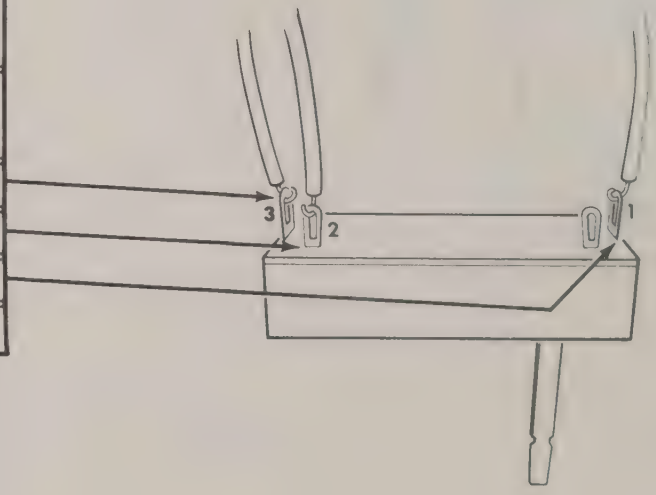
NOTE: The slide control may be supplied with the lugs arranged as shown in Part A or B. The wiring Pictorial, however will only show control A. When you wire to the control, always note the numbers of the lugs stamped on the control and not the position of the lugs. NOTE: There are two lugs marked "2"; one near lug 3, and one near lug 1. The #2 lug near #1 will not be used.

- Prepare the following wires:

  3" red 2" black
  2" white

- Position the 25 kΩ slide control so that lugs 2 and 3 are on the left as shown.
- 3" red wire to lug 3 (S-1).
- 2" white wire to lug 2 (S-1).
- 2" black wire to lug 1 (S-1).

Set the control aside temporarily.

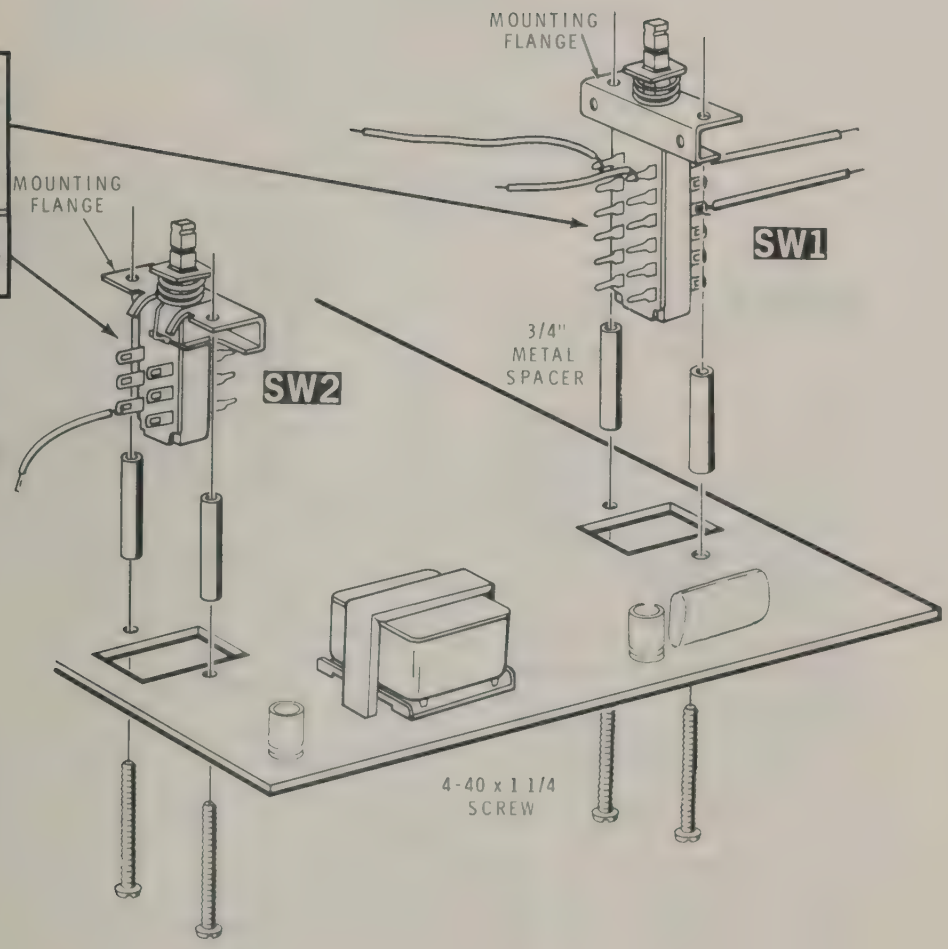


PICTORIAL 6-3

START

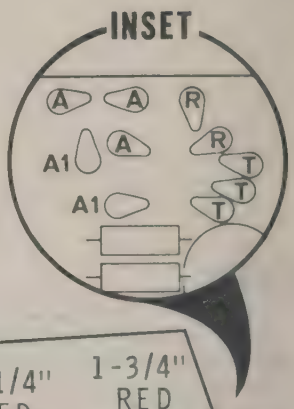
( ) Position the circuit board component-side up and the 12-lug switch with the mounting flange as shown and mount it on the circuit board at SW1. Use 3/4" metal spacers and 4-40 x 1-1/4" screws.

( ) Similarly mount the 6-lug switch at SW2. Note the position of the mounting flange.



PICTORIAL 6-4

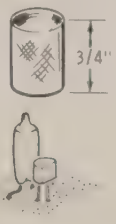
KEEP YOUR SOLDERING IRON TIP CLEAN

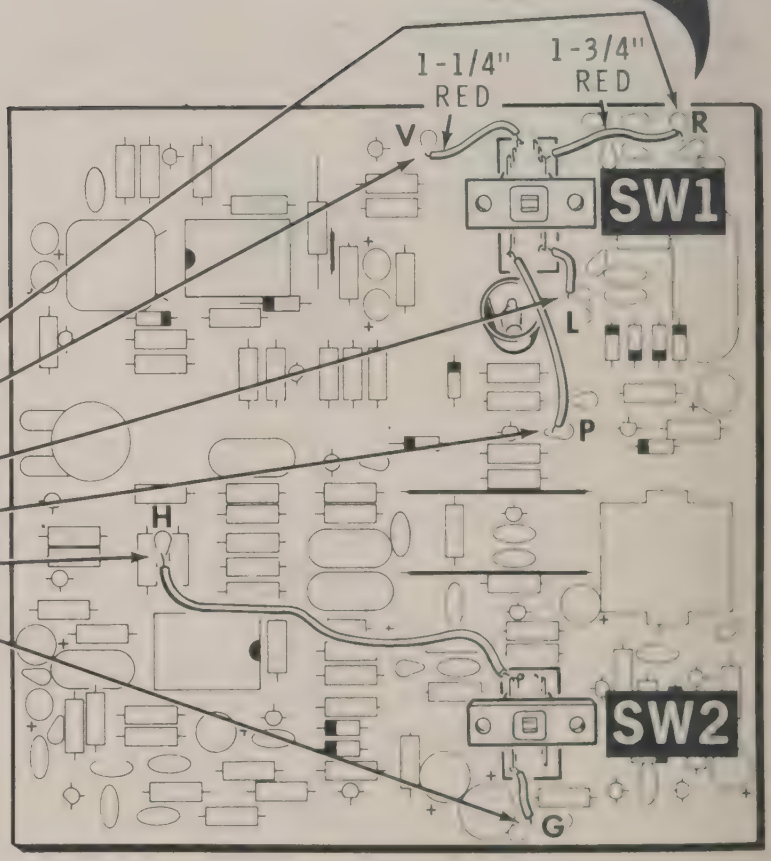


START

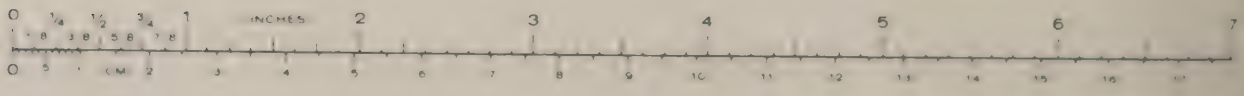
Connect the wires coming from SW1 and SW2 to the circuit board in the following steps. Cut off the excess leads from the foil.

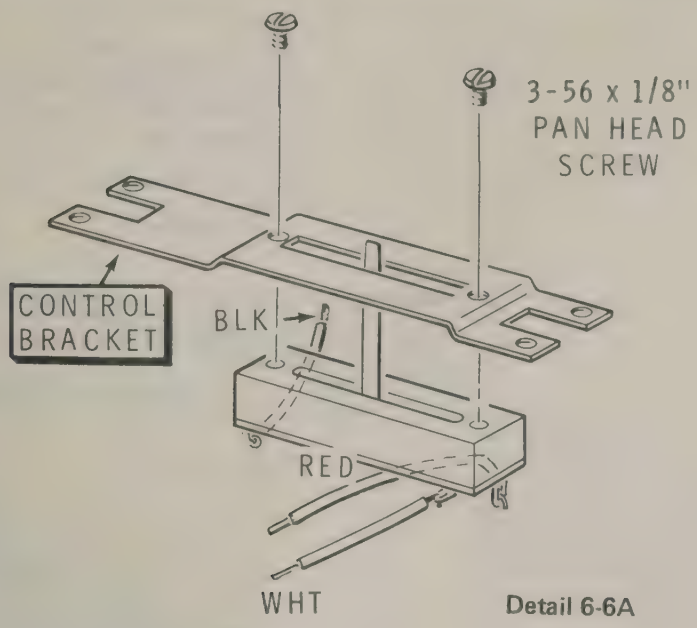
- (✓) The 1-3/4" red wire to the indicated hole R (S-1). See the inset drawing.
- (✓) The 1-1/4" red wire to hole V (S-1).
- (✓) White wire to hole L (S-1).
- (✓) Red wire to hole P (S-1).
- (✓) Black wire to hole H (S-1).
- (✓) Black wire to hole G (S-1).
- (✓) Locate the fiber tubing and cut off a 3/4" piece. Then insert this 3/4" piece over the neon lamp and transistor located near SW1.





PICTORIAL 6-5





Detail 6-6A

START

( ) Position the control bracket and slide control as shown in Detail 6-6A. Mount the control on the bracket with 3-56 x 1/8" pan head screws.

( ) Route the wires, coming from the control as shown in the Detail.

NOTE: Use the plastic nut starter supplied with this kit to hold and start 4-40 x 6-32 nuts on screws.

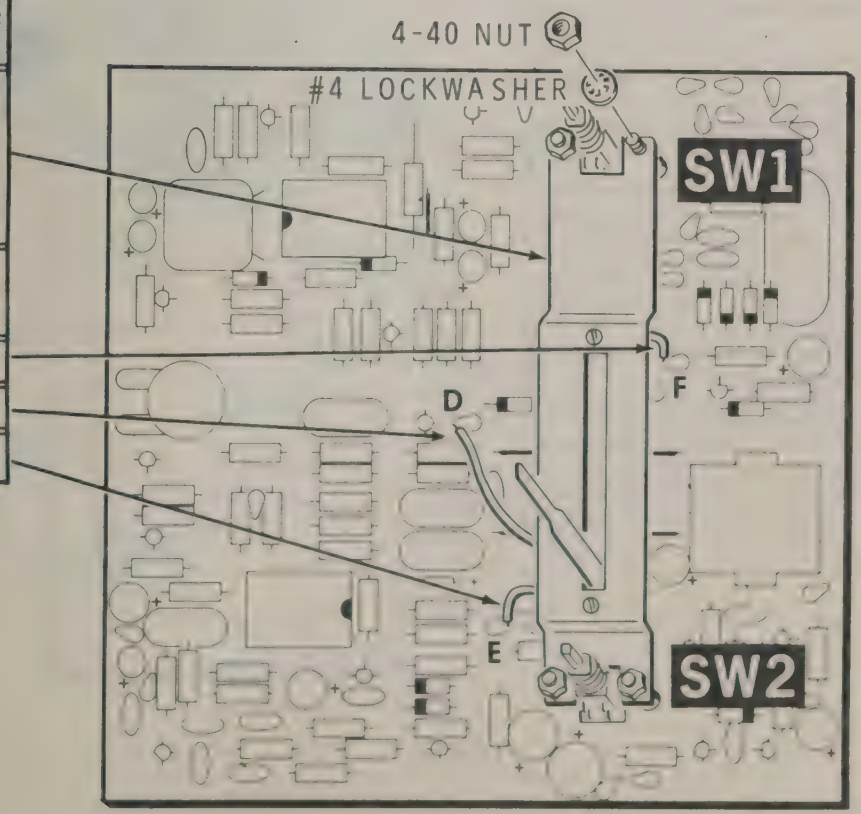
( ) Mount the assembly on SW1 and SW2 with 4-40 nuts and #4 lockwashers. Push the bracket down as far as it will go while checking the control lugs. If they touch any parts on the board, bend the lugs so they do not touch.

Connect the wires coming from the control to the circuit board in the following steps.

( ) Black wire to hole F (S-1).

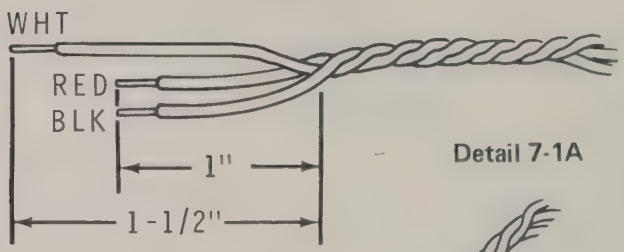
( ) Red wire to hole D (S-1).

( ) White wire to hole E (S-1).



PICTORIAL 6-6

KEEP YOUR SOLDERING IRON TIP CLEAN



Detail 7-1A

START

( ) Prepare both ends of an 11-3/4" black and a 11-3/4" red and a 12" white wire. Start from one end as shown in Detail 7-1A and twist the three wires together.

Connect the irregular length end in the following steps.

( ) Red wire to lug 10 (S-1) of SW1.

( ) Black wire to the indicated hole T (S-1). See the inset.

( ) White wire to hole R1 (S-1). See the inset.

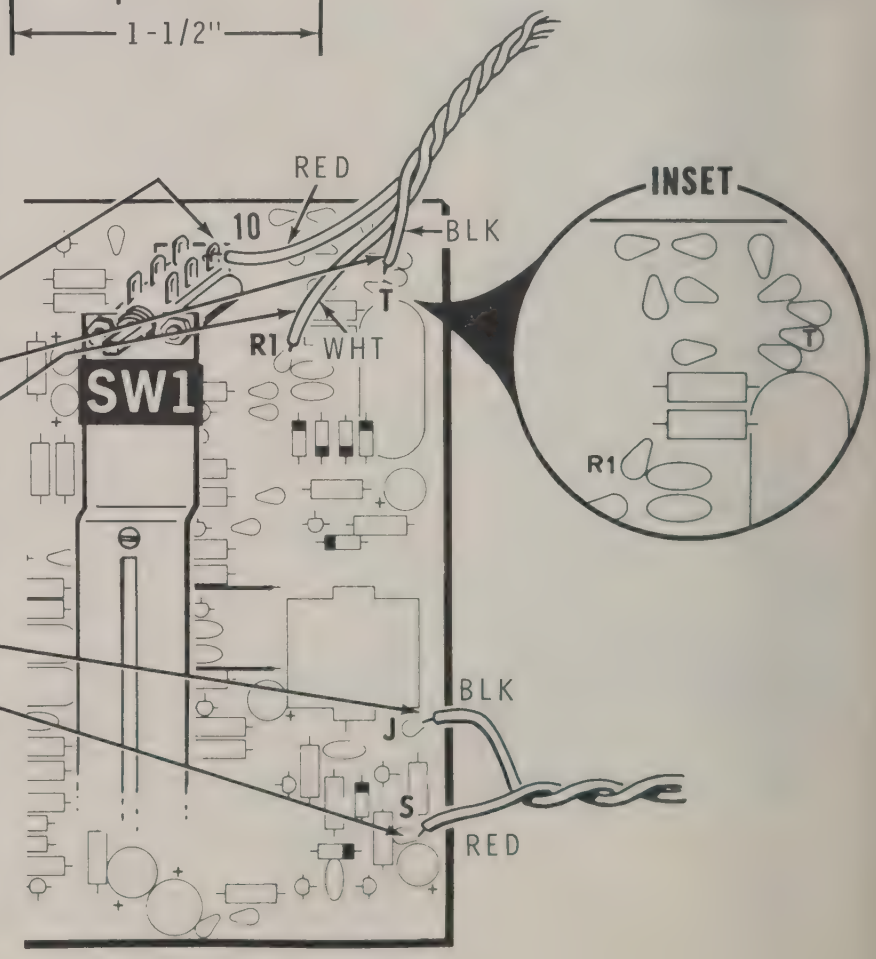
( ) Prepare both ends of a 15" black and a 15" red wire. Then twist the wires together (not the ends).

Connect one end of the twisted wires in the following steps.

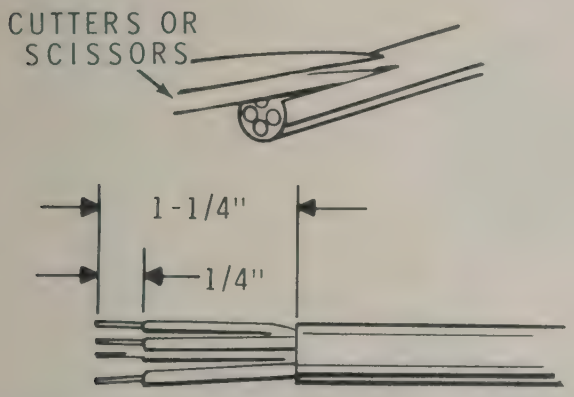
( ) Black wire to hole J (S-1).

( ) Red wire to hole S (S-1).

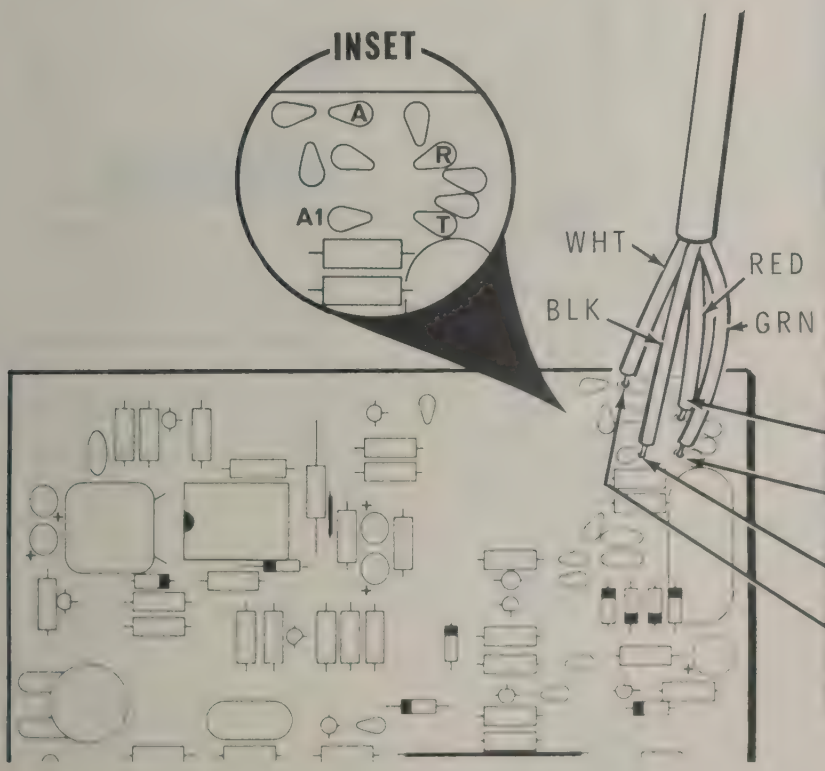
( ) Make sure the excess wire is cut off the foil side of the board.



PICTORIAL 7-1



Detail 7-2A



START

Refer to Detail 7-2A and prepare one end of the 4-wire cable as follows:

A. Remove 1-1/4" of the outer casing. Be careful not to cut the four wires inside the casing. A good way to remove the casing is to use a pair of cutters or scissors and cut along the length of the cable by inserting the point inside the casing.

B. Remove 1/4" of insulation from the end of each wire.

C. Twist the fine strands of wire together and apply a small amount of solder.

Connect the cable in the following steps. Refer to the inset drawing to locate the lettered holes.

( ) Red wire to hole R (S-1).

( ) Green wire to the indicated hole T (S-1).

( ) Black wire to the indicated hole A1 (S-1).

( ) White wire to the indicated hole A (S-1).

Set the circuit board aside temporarily.

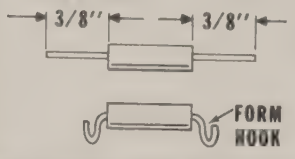
PICTORIAL 7-2

KEEP YOUR SOLDERING IRON TIP CLEAN

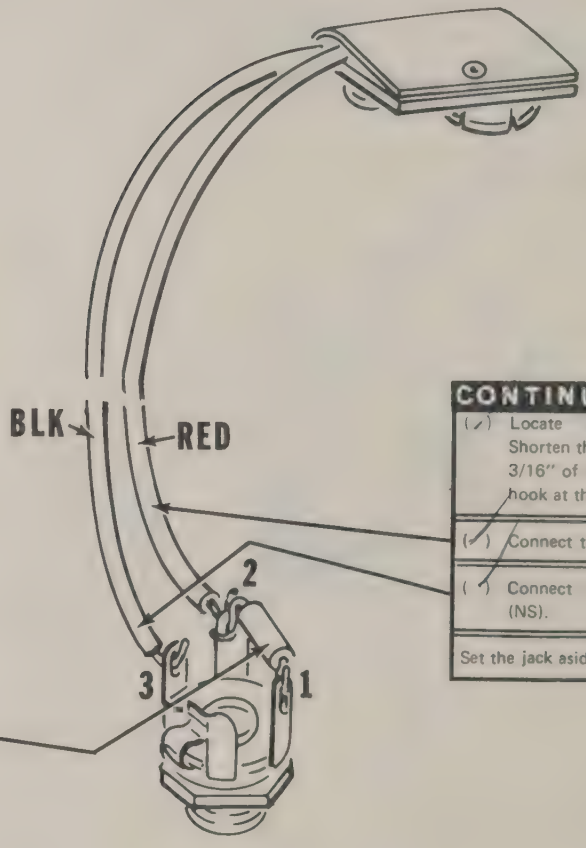
START

( ) Locate the jack. Then bend lugs 1, 2, and 3 out slightly so they will be easier to solder to.

( ) Locate the 220 Ω (red-red-brown) 1/4-watt resistor and prepare the leads as shown.



( ) R77: Connect the resistor between lugs 1 (S-1) and 2 (NS).



CONTINUE

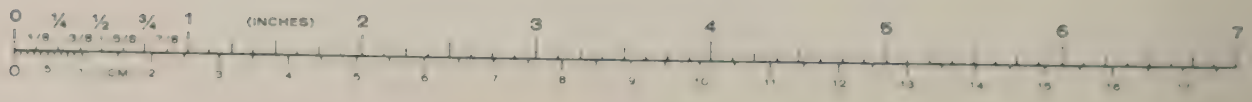
( ) Locate the battery connector. Shorten the end of each lead, leaving 3/16" of the bare end. Form a small hook at these ends.

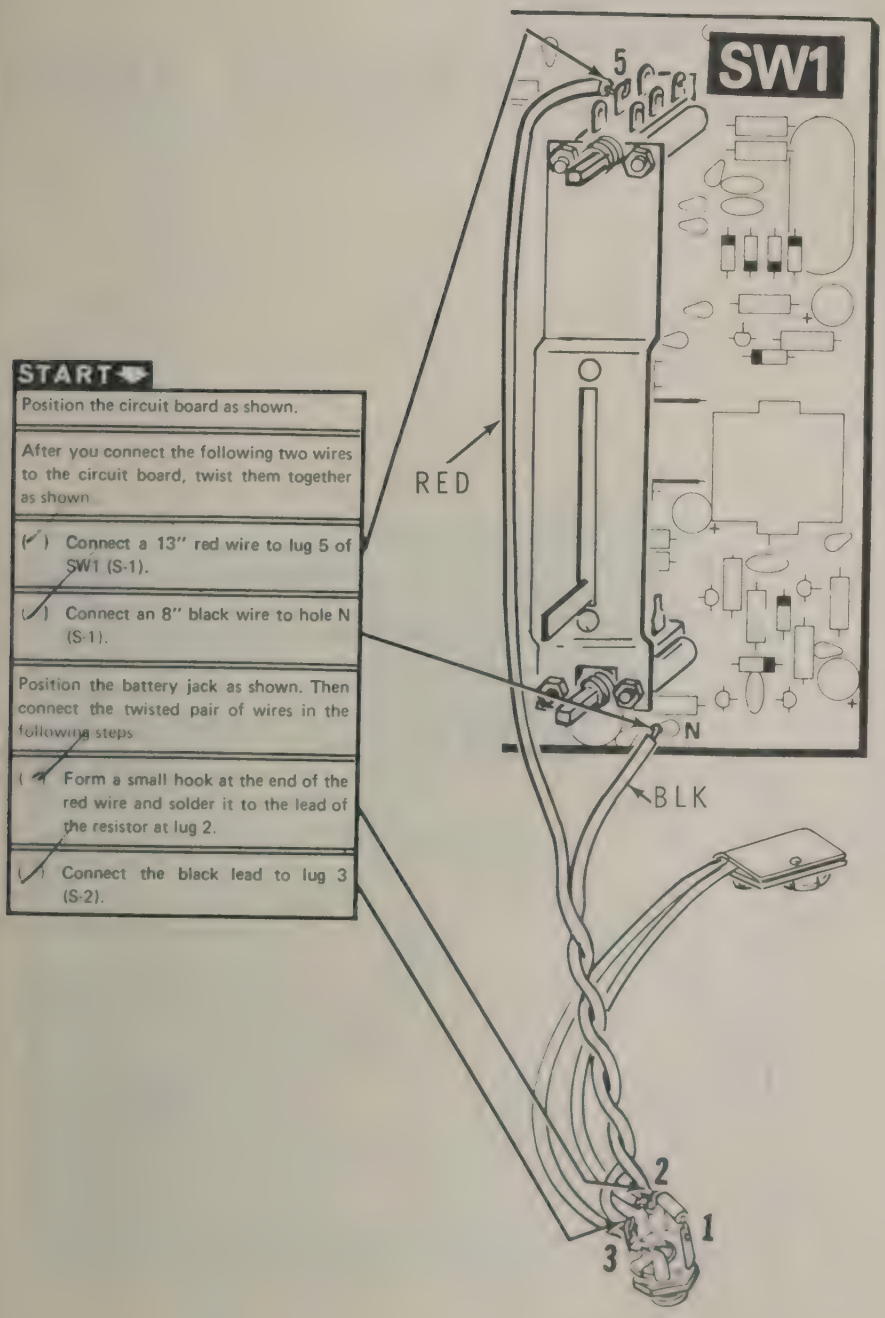
( ) Connect the red lead to lug 2 (S-2).

( ) Connect the black lead to lug 3 (NS).

Set the jack aside temporarily.

PICTORIAL 7-3




START
Position the circuit board as shown.
After you connect the following two wires to the circuit board, twist them together as shown.
( ) Connect a 13" red wire to lug 5 of SW1 (S-1).
( ) Connect an 8" black wire to hole N (S-1).
Position the battery jack as shown. Then connect the twisted pair of wires in the following steps.
( ) Form a small hook at the end of the red wire and solder it to the lead of the resistor at lug 2.
( ) Connect the black lead to lug 3 (S-2).
SW1
5
RED
N
BLK
2
1
3

PICTORIAL 7-4

KEEP YOUR SOLDERING IRON TIP CLEAN

START

Reposition the circuit board so the foil side is up and the Part Number is to your left as shown.

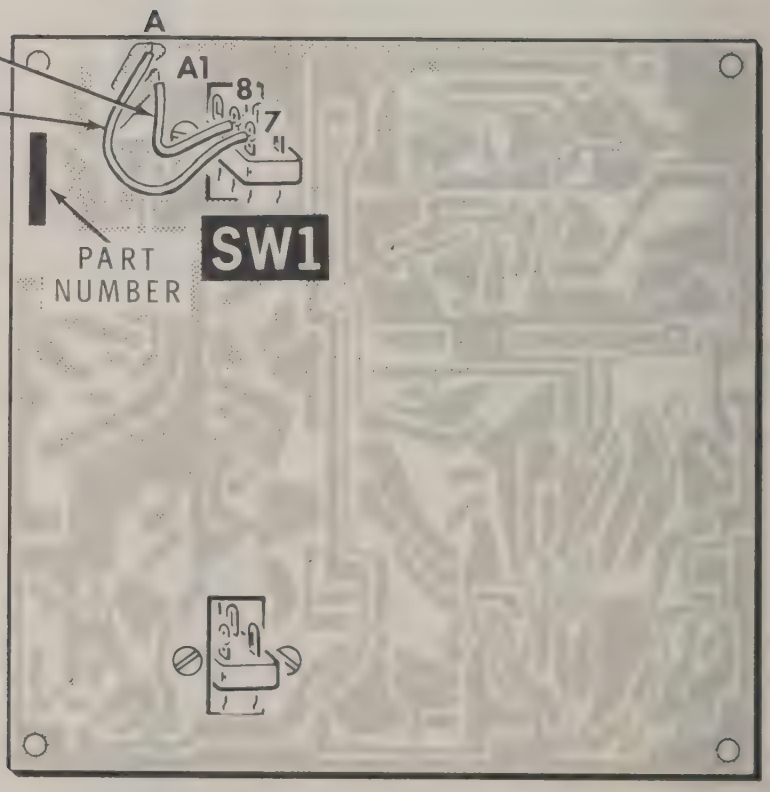
NOTE: When you insert the following wires in the board, leave about 1/8" of bare wire showing so you can solder it to the foil.

( ) Connect a 1-1/4" white wire from lug 8 SW1 (S-1) to hole A-1 (S-1).

( ) Connect a 1-1/2" white wire from lug 7 of SW1 (S-1) to hole A (S-1).

( ) Turn the board over and cut off the excess length protruding from the component side of the board.

Set the circuit board aside.



PICTORIAL 7-5

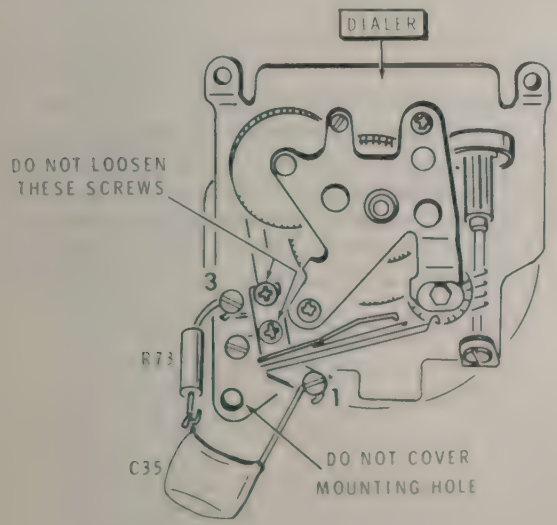
FINAL ASSEMBLY

Refer to Pictorial 8-1 for the following steps.

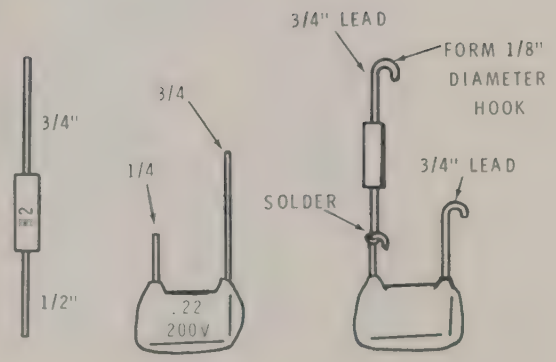
( ) Refer to Detail 8-1A and prepare the leads of an 82 Ω (gray-red-black) resistor and a .22 μF 200V Mylar capacitor as shown.

( ) Position the dialer as shown and loosen screws 1, and 3.

( ) Install the resistor-capacitor combination under screws 1 and 3. Then tighten the screws. NOTE: Be sure you do not cover the mounting holes.



PICTORIAL 8-1



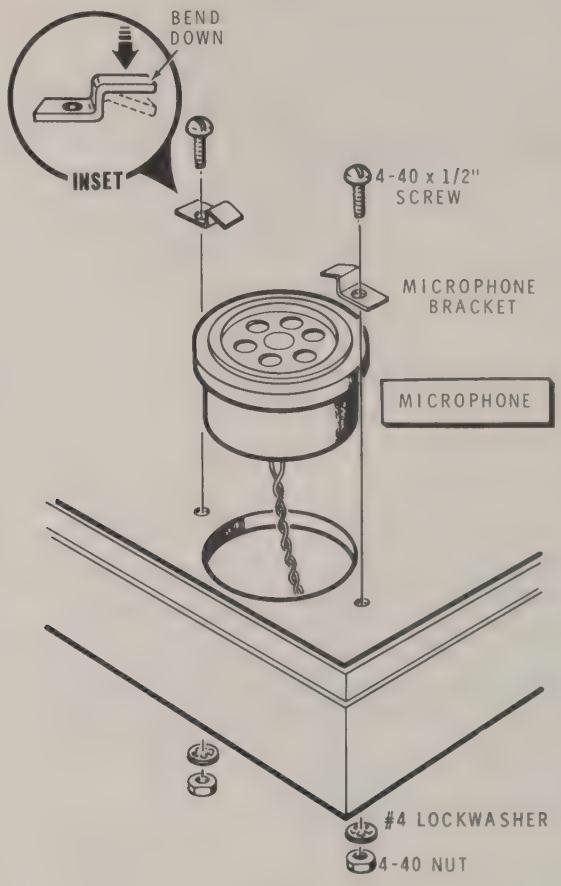
Detail 8-1A

Refer to Pictorial 8-2 in the Illustration Booklet for the following steps.

( ) Place the cabinet face down on a soft cloth so it will not be scratched in the following steps.

( ) Mount the dialer inside the cabinet with #4 x 3/8" self-tapping screws, and #6 fiber washers at locations A and B. Use a 4-40 x 1/2" screw, #6 fiber washer, #4 lockwasher, and 4-40 nut at location C.

( ) Mount the speaker (note the terminal strip) with 6-32 x 3/8" pan-head screws, #6 lockwashers, and 6-32 nuts at locations D, E, and F. The hardware at G will be installed later.



Detail 8-2A

( ) Cut off the microphone leads 8" from the microphone and prepare the ends. Then twist the leads together except at the ends. NOTE: Keep the magnetic face of the microphone away from wire clippings, etc. Also, if the microphone has a plastic cover over the front of it, remove and discard it.

( ) Refer to Detail 8-2A and reposition the cabinet as shown. Place the microphone inside the large hole. Then fasten it in place with 4-40 x 1/2" screws, two microphone brackets, #4 lockwashers and 4-40 nuts. Do not overtighten the screws. NOTE: You may have to bend the brackets slightly if the microphone does not mount securely. See the inset drawing.

Refer to Pictorial 8-3 in the Illustration Booklet for the following steps.

Position the cabinet and circuit board as shown. Then connect the three twisted wires to the dialer in the following steps.

( ) White wire: To the capacitor lead at #1 screw (S-1).

( ) Red wire: To the resistor lead at #3 screw (S-1).

( ) Loosen screw #2. Then form a hook in the black wire, install it under the screw head, and retighten the screw.

( ) Route the twisted wires behind the mounting studs as shown.

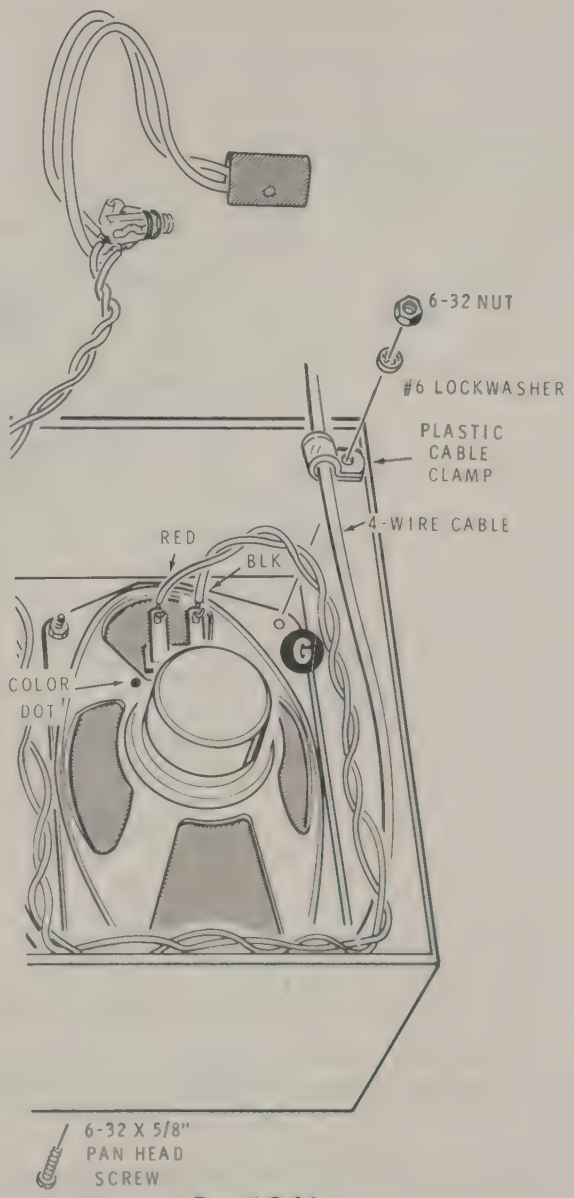
( ) Connect the lead of the microphone to hole B (S-1) and the other lead to hole C (S-1). Cut off the excess leads from the foil.

Refer to Pictorial 8-4 in the Illustration Booklet for the following steps.

( ) Turn the circuit board over and place it inside the cabinet as follows:

1. Make sure the shaft of the slide control goes through the cabinet slot.
2. Route the microphone leads along the inside of the cabinet.
3. Route the jack leads as shown.
4. Route the speaker wires as shown.
5. Route the 4-wire cable as shown.

( ) Fasten the circuit board with four #6 x 3/8" self-tapping screws. Do not overtighten the screws. NOTE: Be careful not to puncture the speaker paper cone when you install the two screws on that side.



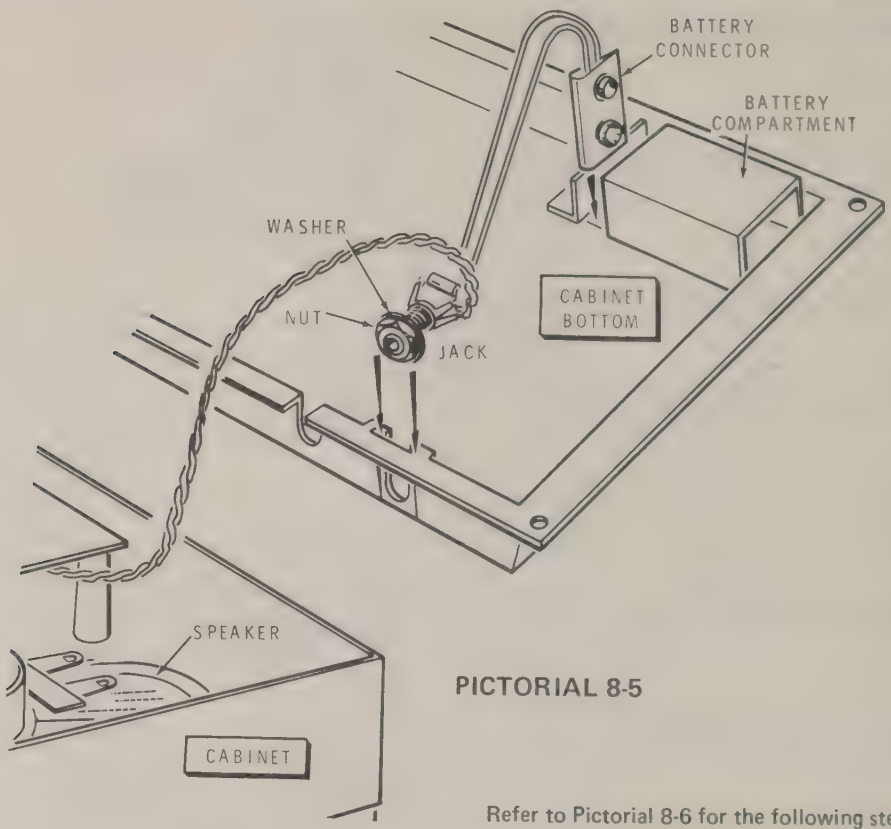
Detail 8-4A

Refer to Detail 8-4A for the following steps.

( ) Connect the red speaker wire to the speaker lug with the color dot (S-1).

( ) Connect the black wire to the other speaker lug (S-1).

( ) Place the plastic cable clamp around the 4-wire cable. Then mount it at G with a 6-32 x 5/8" pan head screw, #6 lockwasher, and 6-32 nut.



PICTORIAL 8-5

Refer to Pictorial 8-5 for the following steps.

( ) Place the cabinet bottom behind the cabinet as shown.

( ) Turn the nut on the jack so it is flush with the end and slide the washer against the nut. Then push the jack in the slot and tighten the nut.

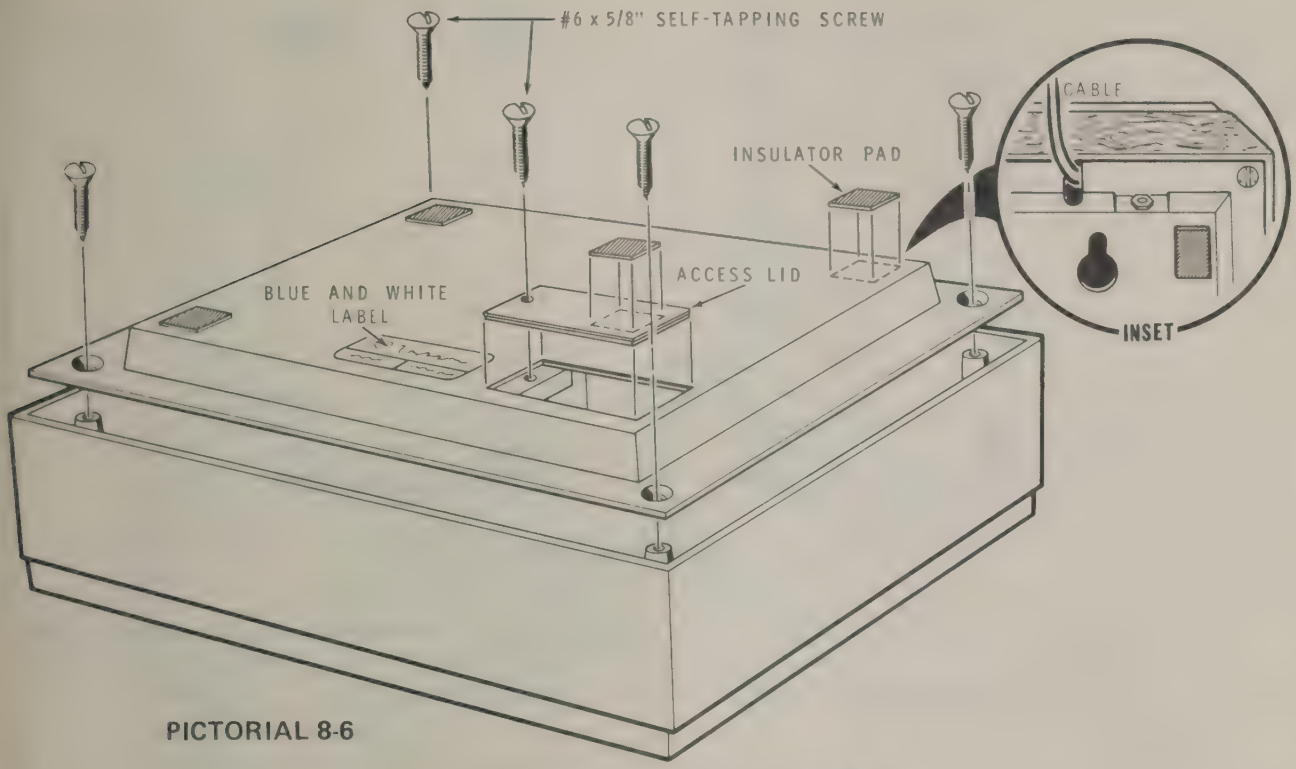
( ) Insert the battery connector through the battery compartment.

Refer to Pictorial 8-6 for the following steps.

( ) Install the cabinet bottom on the cabinet with four #6 x 5/8" self-tapping screws. Route the cable through the slot. See the inset drawing.

( ) Temporarily turn the unit over and make sure the POWER switch is in the Off position. Push the shaft in and release it. Off is the furthest out position.

NOTE: If you plan to use the GRA-43-1 Converter-Charger for a power source instead of a 9 volt battery, do not perform the battery installation in the next step. Continue with the step that comes after it.



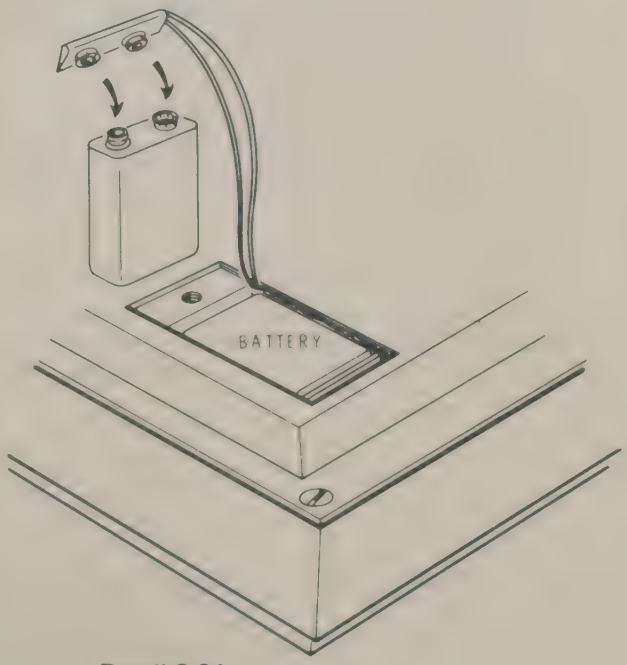
PICTORIAL 8-6

( ) Refer to Detail 8-6A and match the battery terminals with the battery connector and push the connector onto the battery. Then place the battery inside the compartment.

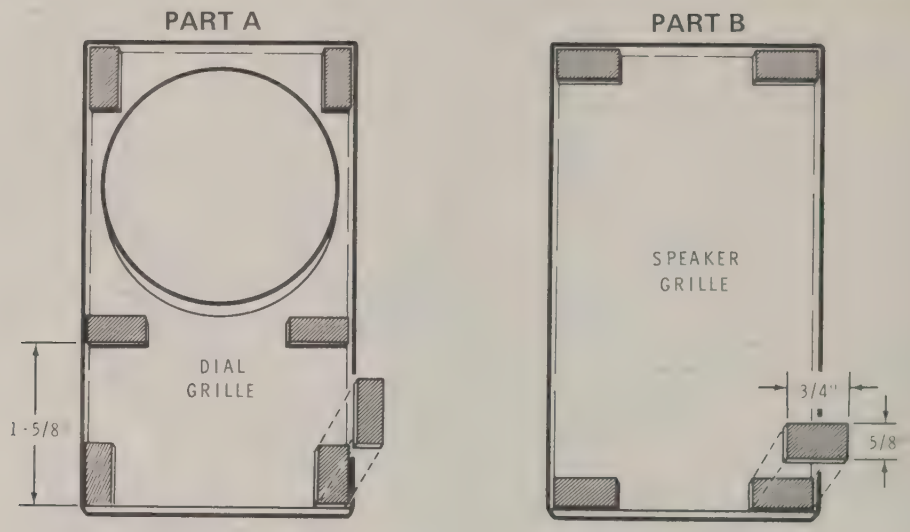
( ) Refer again to Pictorial 8-6 and install the access lid over the battery (battery connector if no battery is used) and fasten it with a #6 x 5/8" self-tapping screw.

( ) Remove the backing from the four insulator pads and stick them on the corners of the cabinet about 3/8" from each edge. NOTE: One insulator will have to be installed on the access lid.

( ) Peel the paper from the blue and white label and install the label on the cabinet bottom. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.



Detail 8-6A



PICTORIAL 8-7

Refer to Pictorial 8-7 for the following steps.

( ) Place the dial grille fabric-side-down on your work surface.

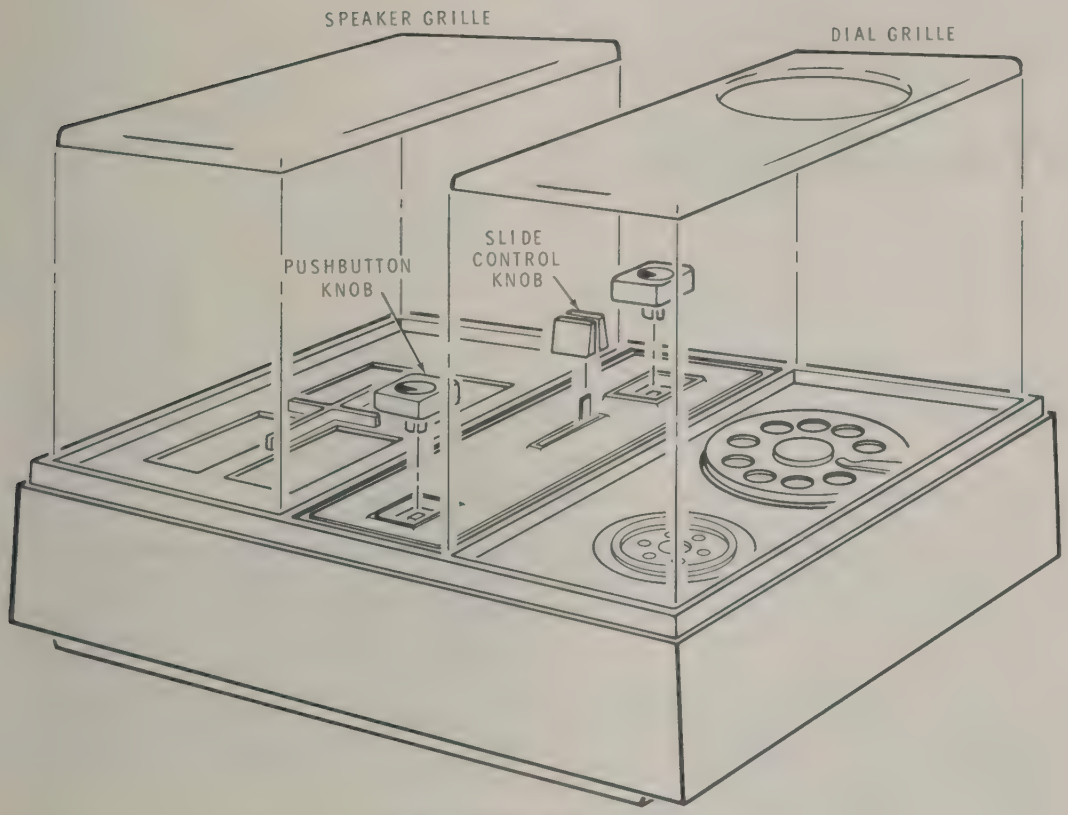
( ) Locate both strips of the two-sided sticky tape and cut twelve 3/8" pieces from one strip. The remaining portion will not be used.

( ) Remove the paper from both sides of six pieces and stick the pieces onto the grille at the locations shown in Part A.

( ) Repeat this procedure with the other six pieces of tape and stick them onto the ones you have already installed on the grille.

( ) Cut the other strip of tape into 5/8" pieces.

( ) Place the speaker grille fabric-side-down on your work surface and similarly install two pieces of tape at each corner as shown in Part B.



PICTORIAL 8-8

Refer to Pictorial 8-8 for the following steps.

( ) Install both grilles on the cabinet.

( ) Insert both pushbutton knobs on the switches. Make sure the POWER switch is Off (out).

( ) Insert the slide control knob on the control.

This completes the assembly of your Heathkit Telephone Amplifier. Proceed to "Installation."

NOTE: The 560 Ω (green-blue-brown) resistor that is left over, is used in the Alignment With Instruments section. This section provides an optional alignment procedure for those who have the necessary equipment.

INSTALLATION

INTRODUCTION

State and Interstate tariffs require that an approved connecting arrangement (coupler) be used to connect any customer-provided device to telephone lines. The coupler is intended to protect the Telephone Company's personnel and equipment from any hazardous voltages or unusual conditions that might occur from these devices.

Two types of couplers (described below) are available from your Telephone Company. When you notify the company, a serviceman will install the coupler so that all you have to do is plug your telephone amplifier into the coupler. Contact your Telephone Company for the installation charges and monthly tariffs in effect in your community.

Three methods of installation (STC coupler, QKT coupler, and Direct hookup) are briefly covered in the following information. Read this information and decide which method you want before you continue with the actual installation instructions.

STC Coupler

With this coupler, your GD-1162 Telephone Amplifier can be used for all of the normal telephone functions (dialing, ringing, talking, and listening). No other accompanying telephone is necessary.

When you order the STC coupler, specify that you will need the Telephone Company-provided power source (provides power for the coupler only), and that you will not need an additional telephone set.

QKT Coupler

This is the least expensive coupler and is often referred to as the "Phone Patch" coupler. With this coupler, your Telephone Amplifier can only be used for talking and listening. The dialing and ringing features are automatically disconnected. When the Telephone Company installs this coupler they also furnish an associated telephone set that connects and disconnects the Telephone Amplifier from the phone line, in addition to providing the normal ringing and dialing functions.

When you order the QKT Coupler from your local Telephone Company, specify that the cutoff key should disable the handset transmitter (microphone).

You will also need a standard 1/4" Phone Plug which is available from your local parts store or from Heath Company as Part Number 438-3.

Direct Hookup

With this method, you connect the Telephone Amplifier directly to the telephone line through the junction box or 4 prong plug/socket arrangement. Your Telephone Amplifier is used for all of the normal telephone functions. No other accompanying telephone is necessary.

The Telephone Amplifier has been designed to meet all domestic standards and can be safely connected directly to the telephone line, but only if this direct connection method. is approved in your area.

STC COUPLER INSTALLATION

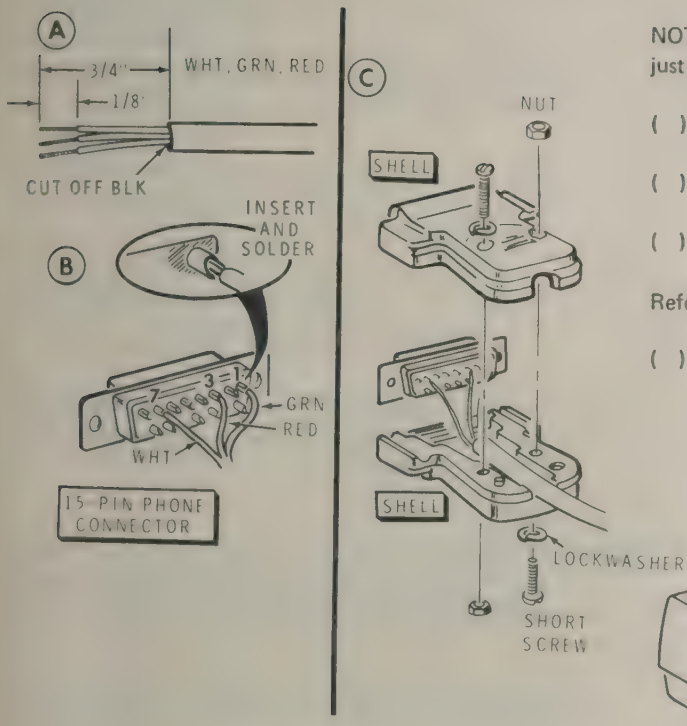


Figure 1-1

( ) Refer to Part A of Figure 1-1 and prepare the end of the 4-wire cable coming from the Telephone Amplifier as follows:

1. Remove 3/4" of the outer casing. Be careful not to cut the four wires inside. A good way to remove the casing is to use a pair of cutters or scissors and cut along the length of the cables by inserting the point inside the casing.

2. Cut off the black wire at the casing. Then remove 1/8" of insulation from each of the three wires, twist the small strands of wire together, and apply a small amount of solder.

Refer to Part B for the following steps.

Locate the 15-pin phone connector and the phone connector shells with hardware.

( ) Position the phone connector so that the row of eight lugs is on top as shown.

NOTE: When you connect the wires in the following steps, just lay the bare end of each wire in the pin and solder it.

( ) Green wire to lug 1.

( ) Red wire to lug 3.

( ) White wire to lug 7.

Refer to Part C of Figure 1-1 for the following steps.

( ) Lay the phone connector and cable in either shell half and place the other shell half on top of it. Then fasten them together with the short screws, the lockwashers, and nuts.

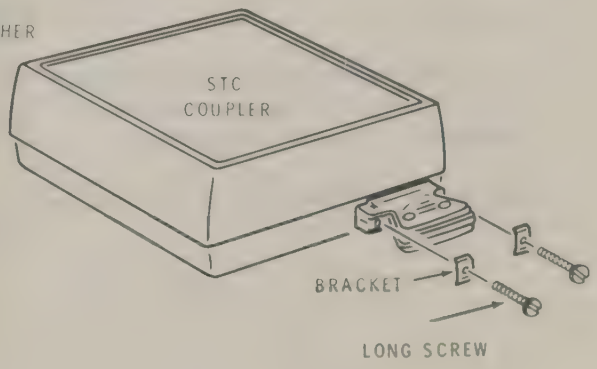


Figure 1-2

Refer to Figure 1-2 for the following steps.

NOTE: Your telephone serviceman should have already installed your STC coupler. For simplification, the coupler in Figure 1-2 is shown only as a rectangular box. The socket where the 15-pin phone connector plugs in can also be at a different location than the one shown.

( ) Match the row of seven pins in the connector with the row of seven holes in the socket and push the connector into the socket. Then fasten it with the long screws and small brackets.

This completes the "STC Coupler Installation." Proceed to **"STC Coupler Tests".**

STC Coupler Tests

( ) Refer to Figure 2-1 (in the Illustration Booklet) and remove the four screws from the case bottom. Then lift the case bottom to expose the white wire. Unplug the wire from connector T and plug it into connector A. Reinstall the four screws.

Refer to Figure 2-2 in the Illustration Booklet for the following steps.

Set the switches and the controls in the following steps.

( ) DEFEAT SQUELCH – Fully clockwise. NOTE: Use a small screwdriver for this adjustment and insert it through the hole in the cabinet bottom. The distance from the hole to the control is approximately 1-1/8".

( ) VOLUME – Down.

( ) LISTEN – Off (out).

( ) POWER – On (in).

( ) Push the VOLUME up and then down. You will hear the dial tone which should increase and decrease respectively.

( ) Advance the VOLUME to halfway.

( ) Dial a friend. You should hear the ring signal and then the answering party. You can adjust the VOLUME as necessary. NOTE: The first syllables of your conversation may be cut off, but this will be remedied with an adjustment later.

( ) Push the LISTEN switch to ON (in). The other party should not be able to hear you, but you should be able to hear him.

( ) Push the LISTEN switch to OFF (out). The other party should be able to hear you again.

( ) Terminate your call by pushing the POWER switch Off (out). Before you do this however, ask the other party to call you back.

( ) When the other person returns your call, you should hear a ring tone. When you do, push the POWER switch to ON and begin your conversation.

Proceed to Page 58 and complete the "Defeat Squelch Adjustments."

QKT COUPLER INSTALLATION

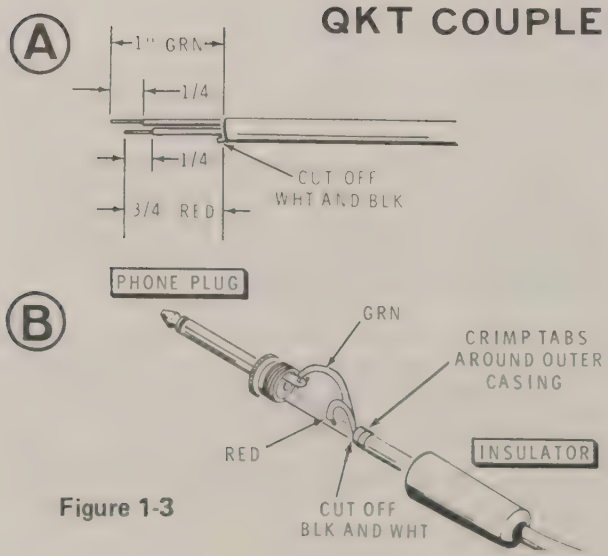


Figure 1-3

( ) Refer to Part A of Figure 1-3 and prepare the end of the 4-wire cable coming from the Telephone Amplifier as follows:

1. Remove 1" of the outer casing. Be careful not to cut the four wires inside. A good way to remove the casing is to use a pair of cutters or scissors and cut along the length of the cables by inserting the point inside the casing.

2. Cut off the black and white wires at the casing and the red wire 3/4" from the casing. Then remove 3/8" of insulation from each of the wires, twist the small strands of wire together, and apply a small amount of solder.

( ) Unscrew the insulator from the phone plug.

( ) Slide the insulator onto the cable. Then solder the red and green wires to the phone plug as shown.

( ) After the phone plug has cooled, crimp the two tabs around the casing. Then reinstall the insulator onto the plug.

Refer to Figure 1-4 for the following steps.

NOTE: Your telephone serviceman should have already installed your QKT coupler.

( ) Insert the phone plug into the coupler.

This completes the "QKT Coupler Installation." Proceed to "QKT Coupler Tests".

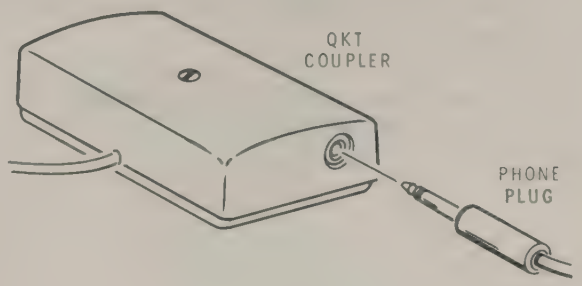


Figure 1-4

QKT Coupler Test

Refer to Figure 2-2 (in the Illustration Booklet) for the following steps.

Set the telephone amplifier controls and switches in the following steps.

( ) DEFEAT SQUELCH - - - Fully clockwise. NOTE: Use a small screwdriver for this adjustment and insert it through the hole in the cabinet bottom. The distance from the hole to the control is approximately 1-1/8".

( ) VOLUME - - - Down.

( ) LISTEN - - - Off (out).

( ) POWER - - - Off (out).

( ) Lift the telephone handset from the cradle.

( ) Rotate the Cutoff Key clockwise.

( ) Pull the Exclusion Key up.

( ) Push the Power switch on your telephone amplifier to "On" (in).

( ) Advance the VOLUME all the way up and then down. You should hear the dial tone increase and decrease.

( ) Push the Power switch Off (out).

( ) Replace your telephone handset on the cradle.

( ) Turn the telephone Cutoff Key counterclockwise.

To place a call to another party, perform the following steps:

( ) Advance the VOLUME to midrange.

( ) Push the POWER switch on (in).

( ) Lift the telephone handset and dial your number.

Once the connection is made, perform the following steps:

( ) Turn the Telephone Cutoff Key clockwise.

( ) Lift the Telephone Exclusion Key. You should now hear the party at the other end when he speaks. Adjust the VOLUME as necessary.

( ) As you answer the party, your first syllables may be cut off. This will be remedied with an adjustment later.

( ) Push the LISTEN switch to ON (in). The other party should not be able to hear you, but you should be able to hear him.

( ) Push the LISTEN switch to Off (out). The other party should be able to hear you again.

( ) Terminate your call by pushing the POWER switch Off (out). Then hang up the handset and turn the Cutoff Key counterclockwise.

Proceed to Page 58 and complete the "Defeat Squelch Adjustments."

DIRECT HOOKUP INSTALLATION

To use the Direct Hookup Method, you must first determine which one of the following types of telephone service you have.

1. Single Party Line or PBX (private branch exchange). PBX would most likely be found in an office.
2. Multiple Party Line.

Determine which one you have, and refer to the instructions under that heading.

SINGLE PARTY OR PBX

The Telephone cable coming from your present telephone may be connected to a 4-prong plug which is plugged into a socket on the wall, or the cable may be connected directly to a junction box mounted on the wall.

If you have the plug and socket arrangement, refer to Parts A and B of Figures 1-5 and perform steps 1 through 6. If you have the junction box arrangement, refer to Parts C and D and perform steps 7 through 14.

1. ( ) Remove 1-1/2" of the outer casing. Be careful not to cut the four wires inside. A good way to remove the casing is to use a pair of cutters or scissors and cut along the length of the cable by inserting the point inside the casing.

2. ( ) Cut off the black and white wires at the casing. Then remove 3/8" of insulation from each of the red and green wires, twist the small strands of wire together, and apply a small amount of solder.

3. ( ) Unpack the 4-prong plug. Do not misplace the screws or housing. Position the plug so the wide spaced prongs are as shown.

4. ( ) Form a hook in each of the green and red wires and fasten them under the indicated screws.

5. ( ) Place the plug inside the housing (make sure all screw heads make contact with the four springs inside the housing). Then fasten the plug with the short screw supplied with it.

6. ( ) Insert the 4-prong plug into the telephone socket.

This completes the "Direct Hookup Installation." Proceed to "Direct-Hookup Tests" on Page 57.

7. ( ) Remove 2-3/4" of the outer casing. Be careful not to cut the four wires inside. A good way to remove the casing is to use a pair of cutters or scissors and cut along the length of the cable by inserting the point inside the casing.

8. ( ) Cut off the black and white wires at the casing. Then remove 3/8" of insulation from the red and green wires, twist the small strands of wire together and apply a small amount of solder.

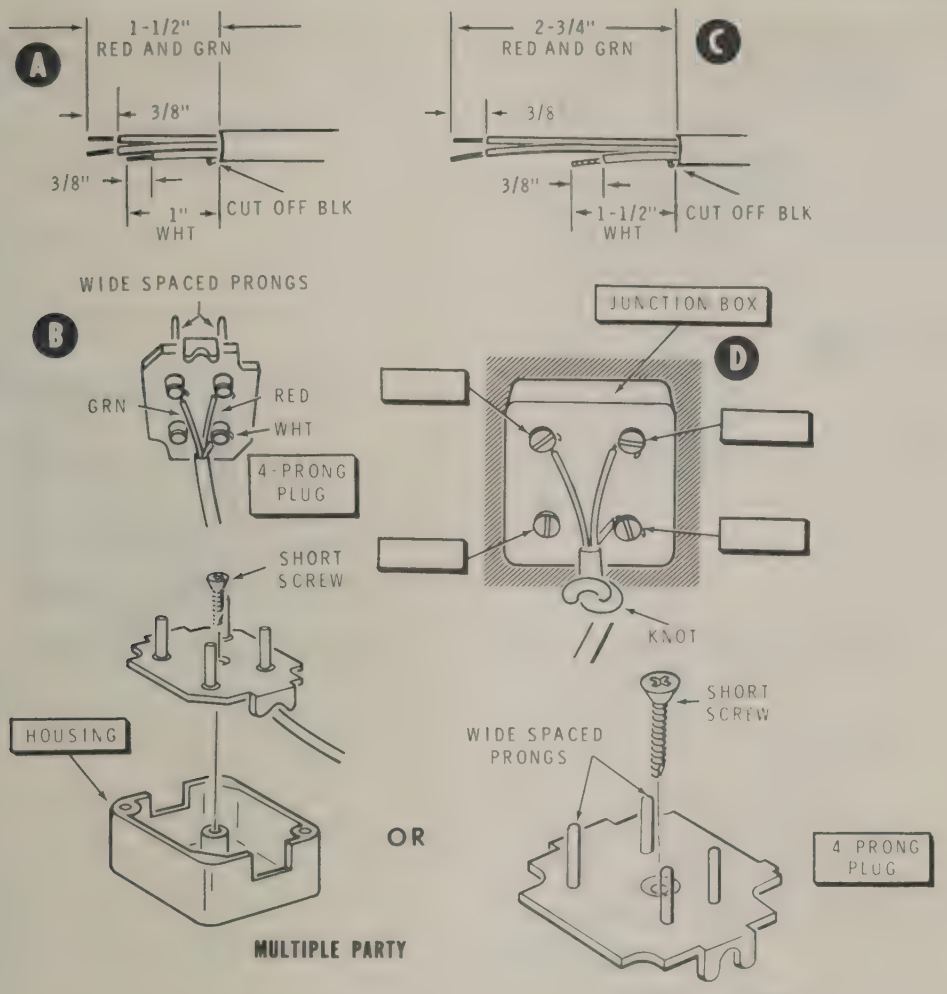


Figure 1-5

9. ( ) Tie a knot in the cable so the knot is at the end of the casing as shown. Then form a hook in the green and red wires of the Telephone Amplifier cable.

10. ( ) Open the junction box exposing the phone connections.

11. ( ) Note the locations of the red, green, yellow, and black wires in the junction box. Write their locations in the four boxes on Figure 1-5 in case any wires should come loose in the following steps.

12. ( ) Loosen the screw head holding the red wire and fasten the red wire of the Telephone Amplifier cable under this screw head. Do not remove any wires from the screw. Then tighten the screw.

13. ( ) Similarly, install the green wire coming from the Telephone Amplifier under the screw head holding the green wires.

14. ( ) Position the knot inside the junction box and close the cover.

This completes the "Direct Hookup Installation." Proceed to "Direct Hookup Tests" on Page 57.

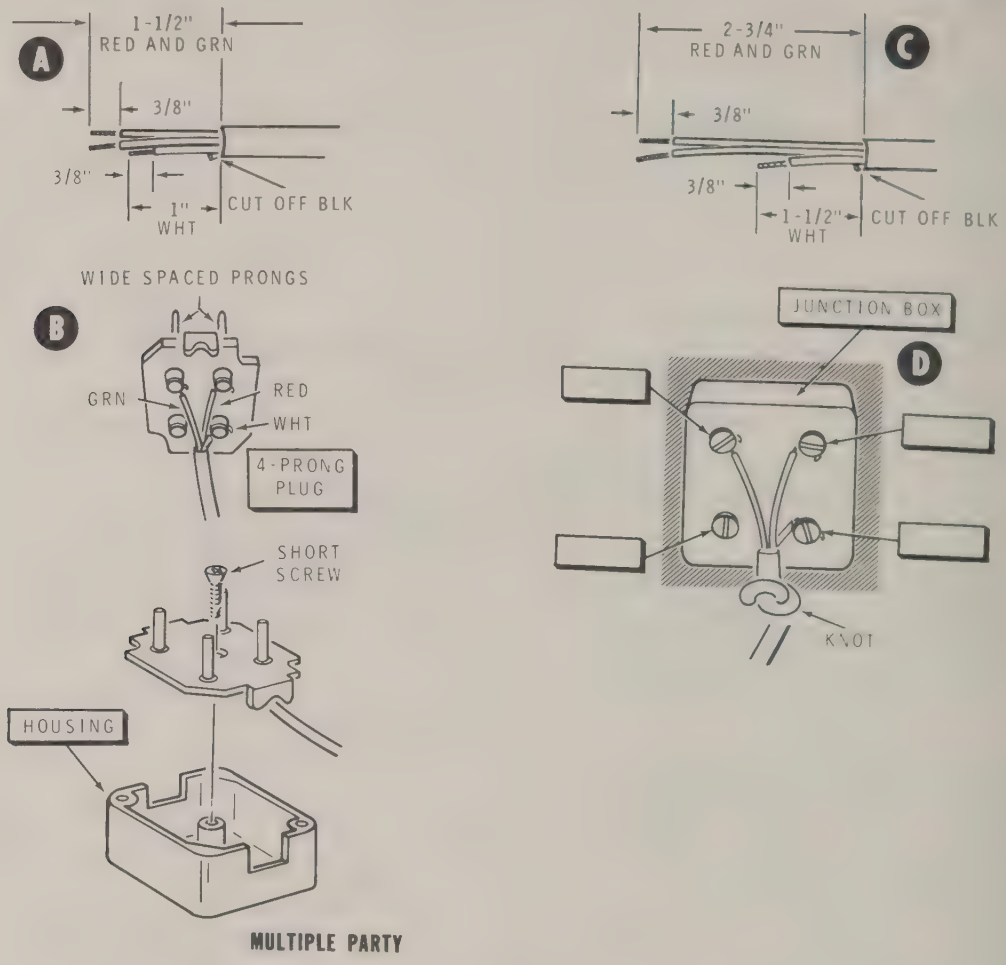


Figure 1-6

MULTIPLE PARTY

If you have the plug and socket arrangement, refer to Parts A and B of Figure 1-6 and perform steps 1 through 6. If you have the junction box arrangement, refer to Parts C and D and perform steps 7 through 15.

1. ( ) Remove 1-1/2" of the outer casing. Be careful not to cut the four wires inside. A good way to remove the casing is to use a pair of cutters or scissors and cut along the length of the cable by inserting the point inside the casing.

2. ( ) Cut off the black wire at the casing. Then cut off the white wire 1" from the casing. Remove 3/8" of insulation from each of the three wires, twist the small strands of wire together, and apply a small amount of solder.

3. ( ) Unpack the 4-prong plug. Do not misplace the screws or housing. Position the plug so the wide spaced prongs are as shown.

4. ( ) Form a hook in each of the three wires and fasten them under the indicated screws.

5. ( ) Place the plug inside the housing (make sure all screw heads make contact with the four springs inside the housing). Then fasten the plug with the short screw supplied with it.

6. ( ) Insert the 4-prong plug into the telephone socket.

This completes the "Direct Hookup Installation." Proceed to "Direct Hookup Tests" on Page 57.

7. ( ) Remove 2-3/4" of the outer casing. Be careful not to cut the four wires inside. A good way to remove the casing is to use a pair of cutters or scissors and cut along the length of the cable by inserting the point inside the casing.

8. ( ) Cut off the black wire at the casing. Then cut off the white wire 1-1/2" from the casing. Remove 3/8" of insulation from each of the three wires, twist the small strands of wire together, and apply a small amount of solder.

9. ( ) Tie a knot in the cable so the knot is at the end of the casing as shown. Then form a hook in the green and red wires of the Telephone Amplifier cable.

10. ( ) Open the junction box exposing the phone connections.

11. ( ) Note the locations of the red, green, yellow, and black wires in the junction box. Write their locations in the four boxes on Figure 1-6 in case any wires should come loose in the following step.

12. ( ) Loosen the screw head holding the red wire and fasten the red wire of the Telephone Amplifier cable under this screw head. Do not remove any wires from the screw. Then tighten the screw.

13. ( ) Similarly, install the green wire coming from the Telephone Amplifier under the screw head holding the green wires.

14. ( ) Similarly, install the white wire coming from the Telephone Amplifier under the screw head holding the yellow wire.

15. ( ) Position the knot inside the junction box and close the cover.

This completes the "Direct Hookup Installation." Proceed to "Direct Hookup Tests."

Direct Hookup Tests

Refer to Figure 2-2 in the Illustration Booklet for the following steps.
Set the switches and the controls in the following steps.

( ) DEFEAT SQUELCH - - - Fully clockwise. NOTE: Use a small screwdriver for this adjustment and insert it through the hole in the cabinet bottom. The distance from the hole to the control is approximately 1-1/8".

( ) VOLUME - - - Down.

( ) LISTEN - - - Off (out).

( ) POWER - - - On (in).

( ) Push the VOLUME up and then down. You will hear the dial tone which should increase and decrease respectively.

( ) Advance the VOLUME to halfway.

( ) Dial a friend. You should hear the ring signal and then the answering party. You can adjust the VOLUME as necessary. NOTE: The first syllables of your conversation may be cut off, but this will be remedied with an adjustment later.

( ) Push the LISTEN switch to ON (in). The other party should not be able to hear you but you should be able to hear him.

( ) Push the LISTEN switch Off (out). The other party should be able to hear you again.

( ) Terminate your call by pushing the POWER switch Off (out). Before you do this however, ask the other party to call you back to see if the ring tone is working in your Telephone Amplifier.

NOTE: If the ring tone works properly when the other party calls you back, proceed to the Operation section on Page 60. If the ring tone does not operate, ask the other party to wait for you to call him back. Then terminate the call and perform the following step.

( ) Refer to Figure 2-1 in the Illustration Booklet and remove the four screws from the case bottom. Then lift the case bottom to expose the white wire. Unplug the wire from connector T and plug it into connector A. Reinstall the four screws.

( ) Call the person back and ask him to dial you again. If the ring tone works, this completes the tests. Proceed to the Operation section on Page 60. If the ring tone still does not work, terminate the call and perform the following steps.

( ) Interchange the red and green wires of the telephone amplifier cable at the junction box or 4-prong plug (depending on which one you have).

( ) Call the other party back and ask him to dial you again to make sure the ring tone works.

Complete the following "Defeat Squelch Adjustments."

DEFEAT SQUELCH ADJUSTMENTS

( ) Refer to the inset drawing on Figure 2-2 and attach a piece of tape on the shaft of a small screwdriver. The shaft of the screwdriver should not be larger than 1/8" diameter. The tape will be used as an identification flag in the following adjustment.

( ) DEFEAT SQUELCH – Insert the screwdriver through the hole in the cabinet bottom. The distance from the hole to the control is approximately 1-1/8". Turn the control fully clockwise and mark the cabinet with a pencil at the flag. Now turn the control fully counterclockwise and mark the cabinet at the flag. Turn the control to midrange and make another mark on the cabinet. Remove the screwdriver.

The DEFEAT SQUELCH control does not change the loudness of the signal going out on the line. It determines the sound level required at the microphone to lock the system in the send condition. The control is adjusted differently for various types of background noises. The control has three main settings which are described in the following information. Also refer to Figure 1-7.

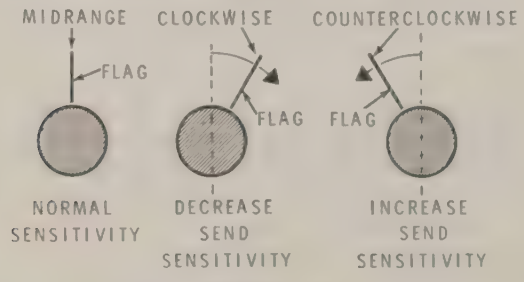


Figure 1-7

NORMAL SEND SENSITIVITY – For this condition the control is set at midrange. This is for use in a room with normal background noise, such as people talking in a normal voice or music playing softly.

DECREASE SEND SENSITIVITY – Between midrange and fully clockwise, the send sensitivity of the amplifier decreases. Adjust the control toward full clockwise for noisy background conditions such as loud noises, Hi-Fi equipment turned up quite high, machinery, etc. You should talk loud enough to overcome the noise.

INCREASE SEND SENSITIVITY – Between midrange and fully counterclockwise the send sensitivity of the amplifier increases. If the background noise is barely audible and you want to increase the operating distance between you and the telephone amplifier, adjust the control toward fully counterclockwise.

NOTES:

You can use your present telephone when making the Defeat Squelch adjustment. You will also need another person to assist you. Note the following conditions before you begin.

(A) You will have to be out of hearing range of each other while speaking in a normal voice; ideally in separate rooms.

(B) You will clear the telephone line by dialing the first digit of your telephone number.

(C) The person who talks into the telephone handset should talk in the normal voice he uses when he talks on the telephone.

(D) When you speak into the telephone amplifier, stay at arms length from the unit and talk in a normal voice into the microphone.

In the following steps you will adjust the DEFEAT SQUELCH control so the first syllables of your conversation will not be cut off. The best way to do this is for both parties to alternately count while you adjust this control.

When you adjust this control for the first time, you will adjust it for Normal Sensitivity. If after this initial adjustment the telephone amplifier will be moved to a noisy area or an exceptionally quiet area, you may have to readjust this control slightly. This will be covered later.

( ) Clear the telephone line by dialing the first digit of your telephone number. Then have the other party lift the handset of his telephone. You are now connected to the other party.

( ) While you and the other party are alternately counting, note whether the first syllables of your conversation are cut off. If they are not cut off, the initial midrange setting of the DEFEAT SQUELCH control is sufficient and no other adjustment is necessary. If the first syllables of your conversation were cut off, insert the screwdriver so the flag is lined up with the midrange mark, and adjust the control slightly counterclockwise until your first syllables are no longer cut off. This adjustment will be very slight.

This completes the adjustment. The following instructions are for adjusting the DEFEAT SQUELCH control if your room conditions for your telephone amplifier are as described on Page 58 under DECREASE SEND SENSITIVITY and INCREASE SEND SENSITIVITY.

DECREASE SEND SENSITIVITY

Set the switches and the controls in the following steps.

( ) VOLUME – Halfway.

( ) LISTEN – Off (out).

( ) POWER – On (in).

( ) Read the notes on Page 58 and then return to the following step.

( ) Clear the telephone line by dialing the first digit of your telephone number. Then have the other party lift the handset of his telephone. You are now connected with the other party.

( ) If you can hear the other party and your first syllables are not cut off, the DEFEAT SQUELCH control is set properly and no other adjustments are necessary. If you could not hear the other party, the DEFEAT SQUELCH control is set too far counterclockwise (sensitivity too high) for the level of room noise. If this is the case, complete the next step.

( ) Insert the screwdriver, so the flag is lined up with the midrange mark, and adjust the DEFEAT SQUELCH control clockwise slightly until you can hear him.

INCREASE SEND SENSITIVITY

Set the switches and the controls in the following steps.

( ) VOLUME – Down.

( ) LISTEN – Off (out).

( ) POWER – On (in).

( ) Read the notes on Page 58. Then return to the following step.

( ) Clear the telephone line by dialing the first digit of your telephone number. Then have the other party lift the handset of his telephone. You are now connected with the other party.

( ) Determine how far you want to be from the telephone amplifier. Then work up to that distance by adjusting the DEFEAT SQUELCH control counterclockwise slightly. If your first syllables are cut off as you begin to move further away from the amplifier, adjust the control slightly counterclockwise again. Do this until your first syllables are no longer cut off and you can obtain the distance you desire. IMPORTANT: Remember, by increasing the sensitivity, the send circuit is susceptible to noise. If the control is turned too far counterclockwise, the receive circuit could be turned off and you would not hear the other party.

OPERATION

INTRODUCTION

With the Telephone Amplifier, you can carry on a two-way conversation without holding a telephone handset. However, both parties cannot talk at the same time as with regular telephones. The Telephone Amplifier switches rapidly back-and-forth between its transmit and receive circuits, depending on which party is talking. Therefore, the listening party should break in at a pause in the conversation. It is important to remember that the party using the regular telephone will gain priority when they talk or even breathe hard into the telephone. If background sounds, such as typing, children playing, etc., are present near the regular telephone, the party talking on the Telephone Amplifier can be cut off. In these cases, the noise must be stopped or the mouthpiece of the telephone covered when that party is not speaking.

If you are using the Heathkit Model GRA-43-1 Converter/Charger for the power source instead of the 9-volt battery, just plug the Converter/Charger into the jack. Always remove the battery when you use the Converter/Charger.

Figure 3-2 in Illustration Booklet identifies the function of the control and switches. The information which follows this illustration tells how to use the Telephone Amplifier with the "Direct Hookup or STC Coupler Installation" or the "QKT Installation." It also describes the problem of Harmonic Ringing.

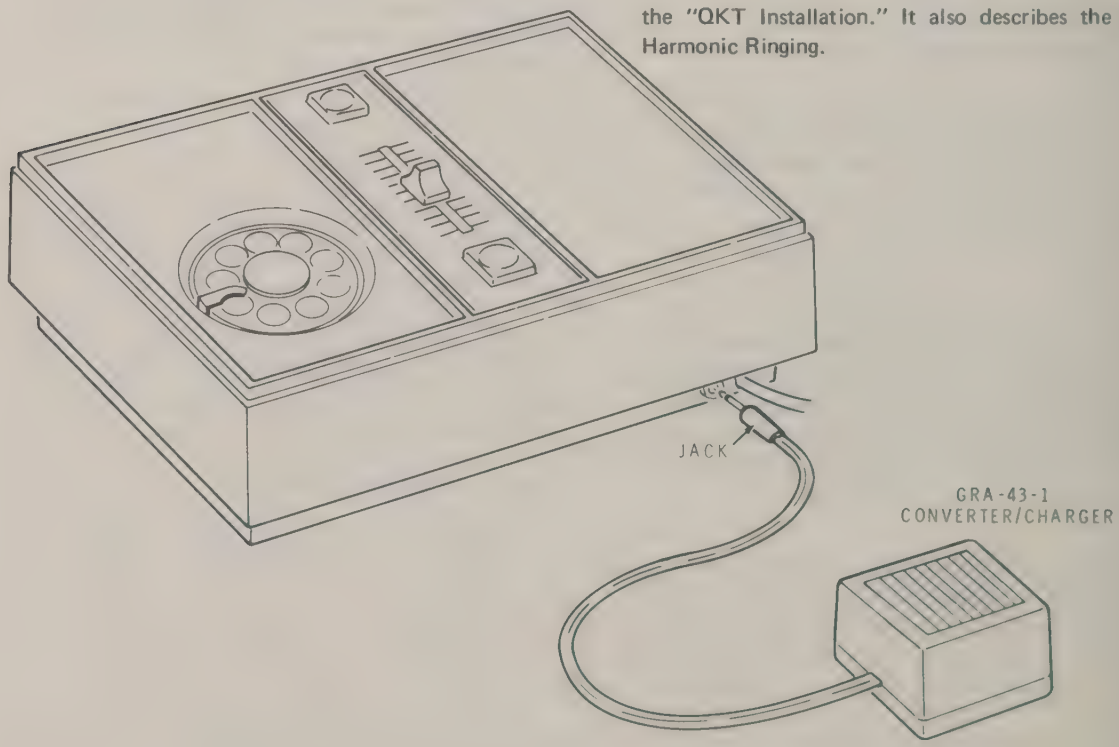


Figure 3-1

DIRECT HOOKUP OR STC COUPLER

To dial a call use the following procedure:

1. POWER switch - - - On (in).
2. LISTEN switch - - Off (out).
3. VOLUME control - - Down.

NOTE: If you dial with the VOLUME control in any position other than the DOWN position in the next step, you may hear a static-like noise coming from the speaker. This is normal. It does not affect the operation of the amplifier or dialer. If the noise annoys you, place the LISTEN switch in the ON (in) position or return the VOLUME control to the DOWN position while you dial.

4. Dial your number. Then advance the VOLUME to midrange.
5. Talk in a normal tone. You do not have to get close to the microphone. In fact, you can be up to 10 feet away from the microphone and still be heard by the other party.
6. If another person is present during your conversation with the other party, and you want to say something privately to the person who is present, just push the LISTEN switch On (in).
7. To terminate your call, push the POWER switch Off (out).
8. When you receive a call, just push the POWER switch On (in). Advance the VOLUME as necessary and talk.

QKT COUPLER

To dial a call use the following procedure:

1. POWER switch - - - On (in).
2. LISTEN switch - - Off (out).
3. VOLUME control - - Down.
4. Lift the handset of your telephone and dial your number.

Once the connection is made, perform the following steps:

5. Turn the Cutoff Key clockwise.
6. Lift the Exclusion Key.
7. Adjust the VOLUME as necessary.

To terminate the call, perform the following steps:

1. Hang up the handset.
2. Turn the Cutoff Key counterclockwise.
3. Push the POWER switch Off (out).

To receive a call, use the following procedure:

1. Lift the handset of your telephone.
2. Lift the Exclusion Key.
3. Turn the Cutoff Key clockwise.
4. Push the POWER switch On (in).
5. Advance the VOLUME to midrange.
6. Push the LISTEN switch Off (out).

To terminate the call, perform the following steps:

1. Hang up the handset.
2. Turn the Cutoff Key counterclockwise.
3. Push the POWER switch off (out).

HARMONIC RINGING

If you are on a party line that uses harmonic ringing, the ring detector in the telephone amplifier will sound when any of the other party's phone rings. This cannot be avoided because the ring detector cannot discriminate between various ring tones. If the increased ringing annoys you, you can disable the ring detector as follows:

( ) Remove the four screws from the cabinet bottom.

( ) Remove the white wire from connector T or A.

( ) Unsolder this wire from hole K.

( ) Replace the cabinet bottom and install the four screws.

IN CASE OF DIFFICULTY

VISUAL INSPECTION

About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering.

Carefully inspect the foil side of the circuit board for the following most commonly made errors. Review Pages 10 and 11 of your "Kit Builders Guide" to remedy these problems, if any exist.

( ) Unsoldered connections. This does not apply to unused holes.

( ) Poor solder connections.

( ) Protruding leads which could touch together.

As you make the following visual checks, refer to the Pictorial where the part was installed and check it against the installation instructions.

( ) Check each diode for the proper type and direction of the banded end.

( ) Check each electrolytic and tantalum capacitor for the correct position of the plus (+) lead.

( ) Check each transistor for the proper type and installation.

( ) Check each integrated circuit for the proper type and installation.

( ) Check the cable wiring and the wiring of the switches and control to make sure the correct colors are going to the correct locations. Trace each wire in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you have consistently overlooked.

( ) Make sure the battery is not faulty. If you use the Converter Charger instead of a battery, make sure it is working properly.

In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

TROUBLESHOOTING CHARTS

PROBLEM	POSSIBLE CAUSE
Cannot hear dial tone.	A) The cause could be in the speaker amplifier circuit. 1. Capacitors C22, C25. 2. Diodes D11, D12. 3. Transistors Q7, Q8, Q9, Q11. B) The cause could be in the off-hook indicator circuit. 1. Capacitor C13. 2. Zener diode ZD9. 3. Diodes D5, D6, D7, D8. 4. Transistor Q5. C) The cause could be in other circuitry. 1. Defeat Squelch control R7. 2. Resistors R14, R16, R17. 3. Power switch SW1. 4. Transformer T1. 5. Transistor Q6. 6. Integrated circuit IC1.
Cannot hear other party.	A) The cause could be in the speaker amplifier circuit. 1. Capacitors C22, C25. 2. Diodes D11, D12. 3. Transistors Q7, Q8, Q9, Q11. B) The cause could be in the off-hook indicator circuit. 1. Capacitor C13. 2. Zener diode ZD9. 3. Diodes D5, D6, D7, D8. 4. Transistor Q5. C) The cause could be in other circuitry. 1. Defeat Squelch control R7. 2. Capacitors C26, C31. 3. Diode D13. 4. Resistor R16. 5. Transistors Q12, Q13, Q14, Q15, Q16. 6. Integrated circuit IC2.

PROBLEM	POSSIBLE CAUSE
Other party cannot hear you.	A) The cause could be in the microphone preamplifier, amplifier, send switch, or line amplifier. 1. Listen switch SW2 pushed in. 2. Too much noise on phone line or at other party end. 3. Capacitors C1, C2, C11. 4. Diodes D1, D2. 5. Transistors Q1, Q2, Q3, Q4. 6. Integrated circuits IC1, IC2. B) The cause could be in other circuitry. 1. Capacitors C27, C29. 2. Resistor R16. 3. Transistors Q12, Q13, Q14, Q15, Q16. C) The cause could be in the off-hook circuitry. 1. Transistor Q5. 2. Capacitor C13. 3. Resistors R18, R19.
Other party can hear you, but your first syllables are cut off.	1. Defeat Squelch control R7 is set too far clockwise. 2. Diode D16.
Ring detector does not work.	A) The cause could be in the speaker amplifier circuit. 1. Capacitors C22, C25. 2. Diodes D11, D12. 3. Transistors Q7, Q8, Q9, Q11. B) The cause could be in other circuitry. 1. Check connections to coupler or phone line. 2. Diodes D14, D15. 3. Lamp NE2. 4. Transistors Q17, Q18, Q19, Q21.
Ring detector works when power switch is turned on.	1. Diode D15.

PROBLEM	POSSIBLE CAUSE
Loud or soft squeal when the POWER switch is turned on.	A) The cause could be feedback. (Both transistors, Q2 and Q6, on at same time.) 1. Resistors R49, R54. 2. Diode D14. 3. Transistors Q2, Q6, Q14. B) The cause could be the ring detector. 1. Diode D15. 2. Transistor Q19. 3. Power switch SW1. C) Another phone off the hook or cut-off key not turned clockwise.
Dialer does not work.	1. Check all connections to the dialer and the phone line. 2. Another telephone off the hook.
The telephone does not ring, but the telephone amplifier does.	1. You are on a party line with harmonic ringing. See Page 61. 2. Check connections to coupler on phone line.

ALIGNMENT WITH INSTRUMENTS

For the following alignment, you will need a voltmeter with at least a 2 megohm input impedance. You will also need a 560 Ω (green-blue-brown) 1/2-watt resistor. This resistor (R78) was included with the kit.

Refer to Figure 4-1 for the following steps.

( ) Remove the cabinet bottom and position the amplifier on its side so the foil side is toward you as shown.

( ) Wrap the bare ends of the red and green leads of the 4-wire cable around the resistor leads.

( ) Turn the Defeat Squelch control fully counterclockwise.

( ) Connect the DC or plus (+) lead of the voltmeter to the indicated foil pattern (pin 2 of IC2).

( ) Connect the common or ground lead of the voltmeter to the black speaker lead or the indicated ground foil.

( ) Push the POWER switch On (in).

NOTE: Perform the following two steps only if the background noise in the room is noticeable. If the room is quiet, proceed to Page 58 and complete the "Defeat Squelch Adjustments." Then return to this Page and complete the steps.

( ) Turn the DEFEAT SQUELCH control slowly clockwise. The meter needle will fluctuate erratically and then begin to slow down and eventually stop at approximately 7.5 V to 9 V. Leave the control set at this point. The gain is now adjusted to make the squelch amplifier as sensitive as possible without being triggered by background noise. You may want to repeat this a couple of times to make sure you have the closest setting.

( ) Now speak in a normal tone of voice. The needle should fluctuate toward zero.

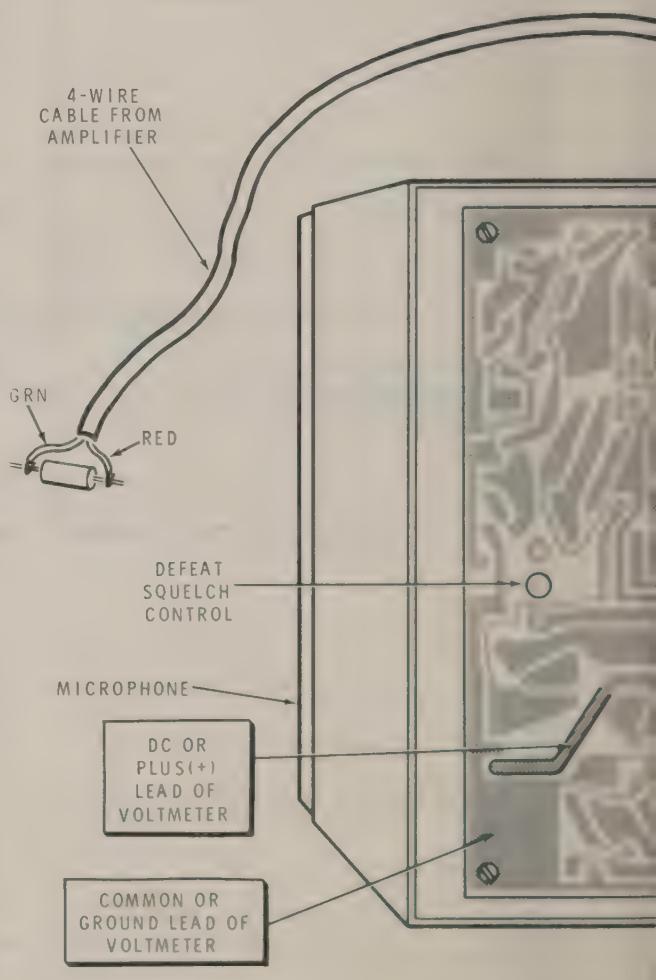


Figure 4-1

( ) Turn the Power switch Off (out).

( ) Disconnect the voltmeter leads, and the resistor.

This completes the Alignment With Instruments.

SPECIFICATIONS

On-Hook Resistance	Open circuit.
Off-Hook Resistance	250 Ω.
Off-Hook Impedance	600 Ω ±10%.
20 Hz Ring Impedance	22 kΩ in series with NE2H neon lamp.
Power Supply	9-volt transistor battery or Heathkit GRA-43-1 Converter/charger.
Battery Life	35 hours or 700 3-minute calls.
Current Drain	8 mA nominal. 25 mA maximum.
Off Current Drain	<100 NA.
Output Level To Line	–10 dBM with normal speech, three feet from microphone.
Frequency Response	–3 dB at 550 Hz and 3000 Hz with 40 dB/octave slopes (send). –3 dB at 300 Hz and 3000 Hz (receive).
Speaker Output	100 mW @ < 1% THD.
Dimensions	8-1/2" W x 2-1/2" H x 5-3/4" D *
Weight	2-1/4 lbs.

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram and to the Block Diagram in the Illustration Booklet while you read this Circuit Description.

MICROPHONE AMPLIFIER

The microphone amplifier circuit consists of transistor Q1, IC1A, and their associated circuitry. The signal from the microphone is coupled through capacitor C1 to the base of transistor Q1. Capacitor C3 is an RF bypass capacitor that filters most of the RF from the input signal. C4 is also an RF bypass capacitor that filters the amplified input signal.

From transistor Q1, the input signal is coupled through C5 and R4 to the input of IC1A. R5 and C6 provide feedback for IC1A. C6 and R5 provide feedback for IC-1A. C5 and R4 along with C8 and R9 determine the low frequency rolloff for the send channel. C6 and R5 along with C9 and R11 determine the high frequency rolloff for the send channel. R6 continuously draws a small current from IC1A to eliminate crossover distortion. The output of IC1A is coupled through C7 to send switch Q2. Transistor Q1, IC1A, and their associated circuits are active at all times. The output of IC1A is switched on and off by send switch Q2.

SEND SWITCH

Transistor Q2 is an FET (Field Effect Transistor) that acts as a switch. When the gate voltage of Q2 is equal to the source voltage, the transistor acts as a closed switch and passes the signal from IC1A. When the gate voltage of Q2 is much greater than the source voltage, the transistor acts as an open switch and blocks the signal from IC1A.

LINE AMPLIFIER

The line amplifier consists of IC1B, transistors Q3 and Q4, and their associated circuitry. The signal from the drain of transistor Q2 is coupled through C8 and R9 to the input of IC1B, which provides further amplification of the input signal. C9 and R11 provide feedback for IC1B. Transistors Q3 and Q4 provide additional current gain to drive the Wheatstone bridge. R12 and R13 and diodes D1 and D2 provide biasing for Q3 and Q4.

WHEATSTONE BRIDGE

Refer to the Block Diagram in the Illustration Booklet for the following circuit description.

The heart of the Telephone Amplifier is a Wheatstone (hybrid) bridge. It consists of resistors R14, R15, and R17 and transformer T1.

The send channel drives the bridge at point A and the send signal is coupled through T1 to the phone line. If the bridge is balanced, for example, R15 is equal to the line resistance (R LINE) and the voltages at B and C will be equal. Therefore, the output of differential amplifier, IC1C, will be zero.

In the receive mode, and with no signal present in the send channel, points A and B will be at signal ground. A signal coming in on the telephone line will drive point C and the positive (+) input of differential amplifier IC1C. With the negative (—) input at signal ground, IC1C has a non-inverting gain and will amplify the signal coming in on the telephone line.

RECEIVE SWITCH

The output signal of IC1C is coupled through C19 to the source of receive switch Q6. Transistor Q6 is an FET that operates identically to send switch Q2 and drives the volume control, R29.

SPEAKER AMPLIFIER

The speaker amplifier circuit consists of transistors Q7 through Q11 and their associated circuitry. The signal from volume control R29 is coupled through C21 to input amplifier Q7. R35 and C22, along with feedback circuit R36 and C23, determine the gain of the amplifier. The signal from transistor Q7 is direct coupled to driver transistor Q8. Resistors R38, and diodes D11 and D12 provide a controlled forward bias on Q9 and Q11 so that class AB operation is maintained. C24 provides high frequency compensation to keep the amplifier stable. The output of transistors Q9 and Q11 is coupled through C25 to the speaker.

SEND AND RECEIVE RECTIFIERS

Refer to the Block Diagram for the following circuit description.

IC2C, transistor Q15, and their associated circuits are a precision, inverting, half-wave rectifier or peak detector. This rectifier generates the absolute value of the signal from the send channel.

IC2D, transistor Q16, and their associated circuits also form a half-wave rectifier or peak detector. This rectifier generates the absolute value of the signal from the receive channel.

The send and receive rectifiers generate voltages A' and D' respectively as shown on the block diagram. Comparator IC2B compares the voltages at A' and D' to determine whether the amplifiers should be in the send or receive mode. When the system is idle, a slight bias is applied to C29 and the positive (+) input of IC2B through R16, R59, and R63. This keeps the comparator (IC2B) output high and in the send mode.

When a signal appears in the send channel, the voltage at A' will exceed the voltage at D', the positive (+) input of IC2B will be higher than the negative (–) input, and the output of the comparator will stay high. When a signal appears in the receive channel, the voltage at D' will exceed the voltage at A', and the comparator output will go low.

When a signal appears in the receive channel, the comparator (IC2B) output goes low and discharges C28 to ground and C27 to ground through diode D13. The voltage across C27 controls the send-receive switches and has a long time constant to keep the received signal from dropping out between syllables or short pauses. As C28 discharges, R53 turns on transistor Q12, which pulls the positive (+) input of IC2A up to +9-volts, to keep the output of IC2A high. R53 and C28 have a very short time constant so that IC2A is disabled only when a receive signal is present. C27, however, will charge back to +9-volts very slowly, unless the holdtime-defeat amplifier takes over.

RECEIVE HOLDTIME-DEFEAT AMPLIFIER

Transistor Q13, IC2A, and their associated circuitry form the receive holdtime-defeat amplifier. This amplifier defeats the long hold time of the switch actuator.

Resistors R39 and R41 establish a reference voltage through R43 at the positive (+) input of comparator IC2A, keeping its output high, so C26 will charge to +9-volts.

The negative (–) input of comparator IC2A samples the output of the microphone amplifier through R42 and defeat squelch control R7. When the microphone signal at the negative (–) input of IC2A exceeds the reference level at the positive (+) input, the output of IC2A will go low and discharge C26 to ground and turn on transistor Q13. When Q13 turns on, it instantly charges C27 back to +9-volts and the switch actuator returns the system to the send mode.

SEND/RECEIVE SWITCH ACTUATOR

Transistor Q14, IC1D, and their associated circuits form the send/receive switch actuator circuit.

IC1D compares the voltage across C27 with a reference voltage. When the voltage across C27 is high, the output of IC1D will be high and the system will be in the send mode. When the voltage across C27 is low, the output of IC1D will be low and the system will be in the receive mode. R48 provides a small amount of positive feedback to decrease the switching time between high and low outputs. The output of IC1D drives the gate of switch Q6 through R49, and drives inverter Q14 through R51. Transistor Q14 in turn, drives the gate of switch Q2.

The "Listen" switch (SW2) can pull the positive (+) input of IC1D to ground, thus locking the system in the receive mode.

RING DETECTOR

R74 and neon bulb NE2 are connected across the telephone line to detect the 90 volt, 20 Hz ring signal. The ring signal will exceed the trigger voltage of the neon lamp and make it glow. This will make transistor Q21, a phono-sensitive Darlington, conduct. The collector current of transistor Q21 turns on transistor Q19 through R72. Transistor Q19 applies +9 volts to the multivibrator circuit and the entire amplifier. The gate of transistor Q6 is pulled up +9 volts through D14 to keep the system in the receive mode.

The multivibrator (transistors Q17 and Q18 and their associated circuitry) generates a tone of approximately 1000 Hz. The 1000 Hz tone is coupled to the input of the speaker amplifier through R65 and C32.

DIALER

The dialer opens the phone line with a series of pulses that corresponds to the digit dialed. It also places a short across the amplifier side of the line to keep the dial pulses from being sent through the amplifier.

OFF–HOOK INDICATOR

Transistor Q5, resistors R18, R19, and capacitor C13 form a current source that is used as an off-hook indicator. The current source draws enough current from the STC coupler or the phone line to signal to the central exchange that the telephone amplifier is off the hook and that the line is in use. The current source appears as a 150 Ω resistor at DC and as a very high impedance at speech frequencies so it does not attenuate signals on the line. A rectifier bridge (diodes D5, D6, D7, and D8) is required to supply the current source because the line voltage reverses during parts of the dialing and answering cycle.

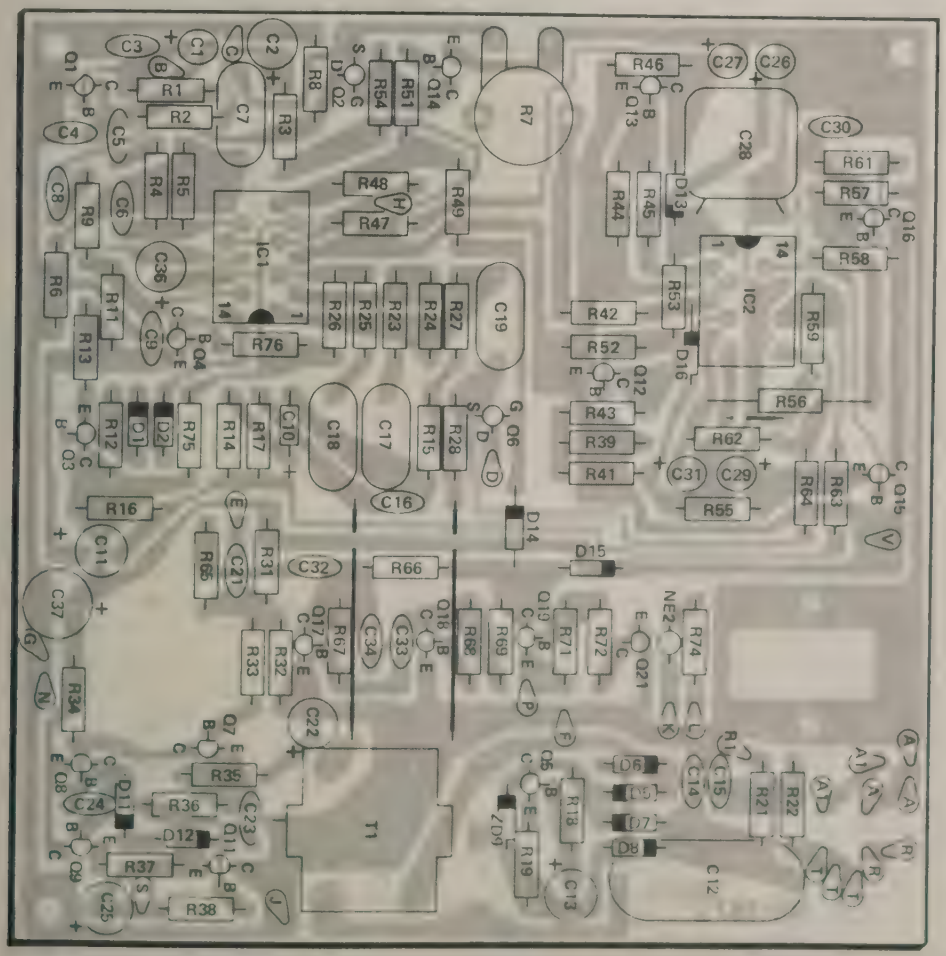
CIRCUIT BOARD X-RAY VIEW

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

A. Find the circuit component number (R5, C3, etc.) on the "X-Ray View."

B. Locate this same number in the "Circuit Component Number" column of the "Parts List."

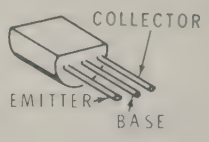
C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



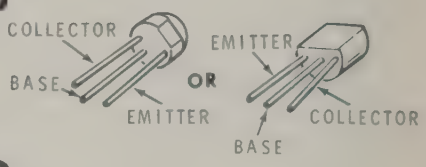
TRANSISTORS-DIODE-
IC IDENTIFICATION CHARTS

TRANSISTOR	HEATH PART NUMBER	REPLACEABLE WITH	BASING DIAGRAM
Q1	417-283	SMO7275	B
Q2	417-858	P1087E	E
Q3	417-801	MPSA20	A
Q4	417-235	2N4121	B
Q5	417-864	MPSA05	A
Q6	417-858	P1087E	E
Q7	417-801	MPSA20	A
Q8	417-235	2N4121	B
Q9	417-801	MPSA20	A
Q11	417-235	2N4121	B
Q12	417-235	2N4121	B
Q13	417-235	2N4121	B
Q14	417-801	MPSA20	A
Q15	417-801	MPSA20	A
Q16	417-801	MPSA20	A
Q17	417-801	MPSA20	A
Q18	417-801	MPSA20	A
Q19	417-235	2N4121	B
Q31	417-859	MRD148	D

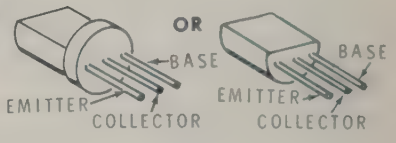
A



B

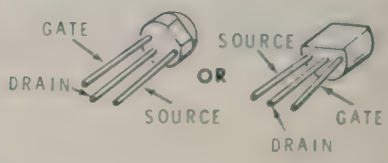


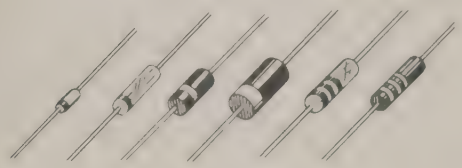
C

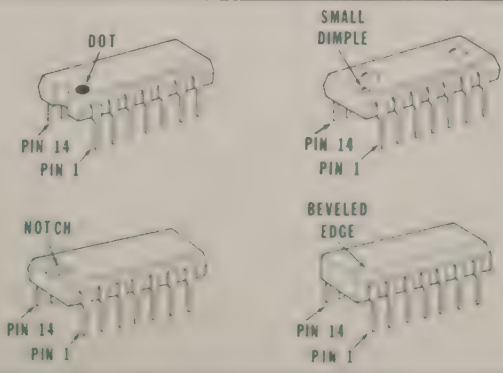


D

E



DIODE	HEATH PART NUMBER	REPLACEABLE WITH	
D1, D2, D11 D12	56-84	1N4148	NOTE: HEATH PART NUMBERS ARE STAMPED ON MOST DIODES. 
D5, D6, D7 D8	57-65	1N4002	
D13, D14, D15, D16	56-56	1N4149	
ZD9	56 25	1N4166A	

INTEGRATED CIRCUIT	HEATH PART NUMBER	REPLACEABLE WITH	
IC1	442-602	324 or 3403	
IC2	442-616	3302 or 2901	

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, $3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

  Total enclosed $_____
- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # _____ Invoice # _____

Date Purchased _____ Location Purchased _____

LIST **HEATH** PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE
TOTAL FOR PARTS			
HANDLING AND SHIPPING			
MICHIGAN RESIDENTS ADD 4% TAX			
TOTAL AMOUNT OF ORDER			

SEND TO: **HEATH COMPANY**
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

CUT ALONG DOTTED LINE

FOR PARTS REQUESTS ONLY

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TOTAL FOR PARTS			
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ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH

Schlumberger

MP MASTER

MA22774

HEATH COMPANY • BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

LITHO IN U.S.A.